DOCUMENT RESUME

ED 412 427 CE 075 008

TITLE	Mechanics. Guide to Standards and Implementation. Career & Technology Studies.
INSTITUTION	Alberta Dept. of Education, Edmonton. Curriculum Standards Branch.
ISBN	ISBN-0-7732-9840-1
PUB DATE	1997-00-00
NOTE	390p.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	MF01/PC16 Plus Postage.
DESCRIPTORS	*Auto Mechanics; Behavioral Objectives; *Competence; Competency Based Education; Course Content; Curriculum Guides; *Employment Potential; Entry Workers; Foreign Countries; *Job Skills; Learning Activities; Learning Modules; *Mechanical Skills; Secondary Education; Teaching Methods; Technical Education; Vocational Education
IDENTIFIERS	Alberta

ABSTRACT

This Alberta curriculum guide defines competencies that help students build daily living skills, investigate career options in the design and repair of motor vehicles, use technology in these fields effectively and efficiently, and prepare for entry into the workplace or related postsecondary programs. The first section provides a program rationale and philosophy for career and technology studies, general learner expectations, program organization information, curriculum and assessment standards, and types of competencies.. The second section provides opportunities for students, through hands-on experiences, to have the opportunity to increase their knowledge and skills related to the design and maintenance of transportation vehicles and the impact they have on the environment, society, and economics. It includes a rationale and philosophy for the logistics strand, strand organization, and planning for instruction. The 54 modules are organized into introductory, intermediate, and advanced levels that cover a comprehensive set of competencies in vehicle design and repair. Modules also define exit-level competencies, specify prerequisites, and outline specific learner expectations. Other sections of the guide contain the following: module curriculum and assessment standards; assessment tools; linkages and transitions with other strands, other educational programs, and to the community, the workplace and the credentialing process; a learning resource guide listing 48 resources keyed to modules, plus additional sources; and sample student learning guides. (KC)

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CAREER & TECHNOLOGY STUDIES

MECHANICS

GUIDE TO STANDARDS AND IMPLEMENTATION

1997

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ALBERTA EDUCATION CATALOGUING IN PUBLICATION DATA

Alberta. Alberta Education. Curriculum Standards Branch.
Mechanics : guide to standards and implementation.

(Career and Technology Studies)
0-7732-9840-1

1. Automobiles—Maintenance and repair—Study and teaching—Alberta.
2. Vocational education—Alberta. I. Title. II. Series: Career and Technology Studies Program.

TJ158.A333 1997 621.8

This document was prepared for:

Administrators	✓
Counsellors	✓
General Audience	
Parents	
Students	
Teachers	✓

Program/Level: Career and Technology Studies/Secondary

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This document supersedes all previous versions of the *Career & Technology Studies Guide to Standards and Implementation*.

This publication is a support document. The advice and direction offered is suggestive except where it duplicates the Program of Studies. The Program of Studies—a prescriptive description of the expectations of student learning, focusing on what students are expected to know and be able to do—is issued under the authority of the Minister of Education pursuant to section 25(1) of the *School Act*, Statutes of Alberta, 1988, Chapter S-3.1 as amended, and is required for implementation. **Within this document, the Program of Studies is shaded so that the reader may readily identify all prescriptive statements or segments.**

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Outside of Edmonton dial 310-0000 to be connected toll free.

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CAREER AND TECHNOLOGY STUDIES

A. PROGRAM RATIONALE AND PHILOSOPHY

Through Career and Technology Studies (CTS), secondary education in Alberta is responding to the many challenges of modern society, helping young people develop daily living skills and nurturing a flexible, well-qualified work force.

In Canada's information society, characterized by rapid change in the social and economic environment, students must be confident in their ability to respond to change and successfully meet the challenges they face in their own personal and work lives. In particular, they make decisions about what they will do when they finish high school. Many students will enter the work force, others will continue their education. All students face the challenges of growing independence and responsibility, and of entering post-secondary programs and/or the highly competitive workplace.

Secondary schools also face challenges. They must deliver, on a consistent basis, high quality, cost-effective programs that students, parents and the community find credible and relevant.

CTS helps schools and students meet these challenges. Schools can respond more efficiently and effectively to student and community needs and expectations by taking advantage of the opportunities in the CTS curriculum to design courses and access school, community and distance learning resources. Students can develop the confidence they need as they move into adult roles by assuming increased responsibility for their learning; cultivating their individual talents, interests and abilities; and by defining and acting on their goals.

As an important component of education in Alberta secondary schools, CTS promotes student achievement by setting clear expectations and recognizing student success. Students in CTS develop competencies—the knowledge, skills and attitudes they are expected to demonstrate, that is, what they know and what they are able to do.

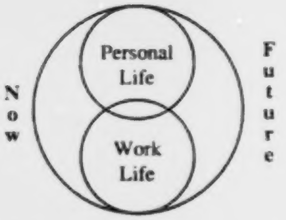
Acquired competencies can be applied now and in the future as students make a smooth transition into adult roles in the family, community, workplace and/or further education. To facilitate this transition, clearly stated expectations and standards have been defined in cooperation with teachers, business and industry representatives and post-secondary educators.

CTS offers all students important learning opportunities. Regardless of the particular area of study chosen, *students* in CTS *will*:

- develop skills that can be applied in their daily lives, now and in the future
- refine career-planning skills
- develop technology-related skills
- enhance employability skills
- apply and reinforce learnings developed in other subject areas.

In CTS, students build skills they can apply in their everyday lives. For example, in the CTS program, particularly at the introductory levels, students have the opportunity to improve their ability to make sound consumer decisions and to appreciate environmental and safety precautions.

CAREERS



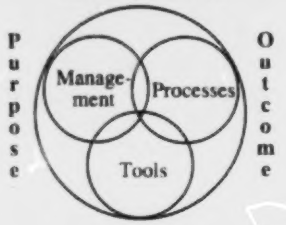
A career encompasses more than activities just related to a person's job or occupation; it involves one's personal life in both local and global contexts; e.g., as a family member, a friend, a community volunteer, a citizen of the world.

The integration of careers throughout the CTS program helps students to make effective career decisions and to target their efforts. CTS students will have the opportunity to expand their knowledge about careers, occupations and job opportunities, as well as the education and/or training requirements involved. Also, students come to recognize the need for lifelong learning.

Students in CTS have the opportunity to use and apply technology and systems effectively and efficiently. This involves:

- a decision regarding which processes and procedures best suit the task at hand
- the appropriate selection and skilled use of the tools and/or resources available
- an assessment of and management of the impact the use of the technology may have on themselves, on others and on the environment.

TECHNOLOGY



Integrated throughout CTS are employability skills, those basic competencies that help students develop their personal management and social skills. Personal management skills are improved as students take increased responsibility for their learning, design innovative solutions to problems and challenges, and manage resources effectively and efficiently. Social skills improve through learning experiences that require students to work effectively with others, demonstrate teamwork and leadership, and maintain high standards in safety and accountability.

As well as honing employability skills, CTS reinforces and enhances learnings developed in core and other complementary courses. The curriculum emphasizes, as appropriate, the effective application of communication and numeracy skills.

In addition to the common outcomes described above, students focusing on a particular area of study will develop career-specific competencies that support entry into the workplace and/or related post-secondary programs. Career-specific competencies can involve understanding and applying appropriate terminology, processes and technologies related to a specific career, occupation or job.

GENERAL LEARNER EXPECTATIONS

General learner expectations describe the basic competencies integrated throughout the CTS program.

Within an applied context relevant to personal goals, aptitudes and abilities; *the student* in CTS *will*:

- demonstrate the basic knowledge, skills and attitudes necessary for achievement and fulfillment in personal life
- develop an action plan that relates personal interests, abilities and aptitudes to career opportunities and requirements
- use technology effectively to link and apply appropriate tools, management and processes to produce a desired outcome
- develop basic competencies (employability skills), by:
  - selecting relevant, goal-related activities, ranking them in order of importance, allocating necessary time, and preparing and following schedules (managing learning)
  - linking theory and practice, using resources, tools, technology and processes responsibly and efficiently (managing resources)
  - applying effective and innovative decision-making and problem-solving strategies in the design, production, marketing and consumption of goods and services (problem solving and innovation)
  - demonstrating appropriate written and verbal skills, such as composition, summarization and presentation (communicating effectively)
  - participating as a team member by working cooperatively with others and contributing to the group with ideas, suggestions and effort (working with others)
  - maintaining high standards of ethics, diligence, attendance and punctuality, following safe procedures consistently, and recognizing and eliminating potential hazards (demonstrating responsibility).

PROGRAM ORGANIZATION

CURRICULUM STRUCTURE

Career and Technology Studies is organized into **strands** and **modules**.

Strands in CTS define competencies that help students:

- build daily living skills
- investigate career options
- use technology (managing, processes, tools) effectively and efficiently
- prepare for entry into the workplace and/or related post-secondary programs.

In general, strands relate to selected industry sectors offering positive occupational opportunities for students. Some occupational opportunities require further education after high school, and some allow direct entry into the workplace. Industry sectors encompass goods-producing industries, such as agriculture, manufacturing and construction; and service-producing industries, such as business, health, finance and insurance.

Modules are the building blocks for each strand. They define what a student is expected to know and be able to do (exit-level *competencies*). Modules also specify prerequisites. Recommendations for module parameters, such as instructional qualifications, facilities and equipment can be found in the guides to implementation.

The competencies a student must demonstrate to achieve success in a module are defined through the *module learner expectations*. Senior high school students who can demonstrate the module learner expectations; i.e., who have the designated competencies, will qualify for one credit toward their high school diploma.

Specific learner expectations provide a more detailed framework for instruction. Within the context of module learner expectations, the specific learner expectations further define the knowledge, skills and attitudes the student should acquire.

The following chart shows the 22 strands that comprise the CTS program and the number of modules available in each strand.

Strand	No. of Modules
1. Agriculture	33
2. Career Transitions	28
3. Communication Technology	33
4. Community Health	31
5. Construction Technologies	46
6. Cosmetology	58
7. Design Studies	31
8. Electro-Technologies	37
9. Energy and Mines	26
10. Enterprise and Innovation	8
11. Fabrication Studies	41
12. Fashion Studies	29
13. Financial Management	14
14. Foods	37
15. Forestry	21
16. Information Processing	48
17. Legal Studies	13
18. Logistics	12
19. Management and Marketing	19
20. Mechanics	54
21. Tourism Studies	24
22. Wildlife	17

LEVELS OF ACHIEVEMENT

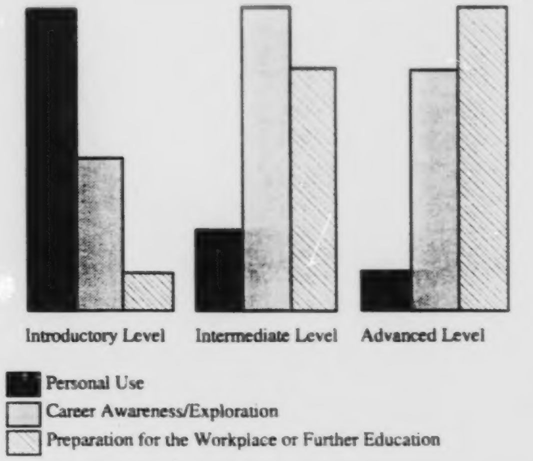
Modules are organized into three levels of achievement: **introductory**, **intermediate** and **advanced**. As students progress through the levels, they will be expected to meet higher standards and demonstrate an increased degree of competence, in both the general learner expectations and the module learner expectations.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are for students who have no previous experience in the strand.

Intermediate level modules build on the competencies developed at the introductory level. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

Advanced level modules refine expertise and help prepare students for entry into the workplace or a related post-secondary program.

The graph below illustrates the relative emphasis on the aspects of career planning at each of the levels.



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CURRICULUM AND ASSESSMENT STANDARDS

Curriculum standards in CTS define what students must know and be able to do. Curriculum standards are expressed through general learner expectations for CTS, and through module and specific learner expectations for each strand.

Assessment standards define how student performance is to be judged. In CTS, each assessment standard defines the conditions and criteria to be used for assessing the competencies of each module learner expectation. To receive credit for a module, students must demonstrate competency at the level specified by the conditions and criteria defined for each module learner expectation.

Students throughout the province receive a fair and reliable assessment as they use the standards to guide their efforts, thus ensuring they participate more effectively and successfully in the learning and assessment process. Standards at advanced levels are, as much as possible, linked to workplace and post-secondary entry-level requirements.

TYPES OF COMPETENCIES

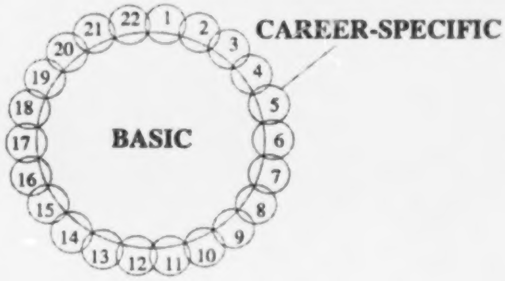
Two types of competencies are defined within the CTS program: basic and career-specific.

Basic competencies are generic to any career area and are developed within each module. Basic competencies include:

- personal management; e.g., managing learning, being innovative, ethics, managing resources
- social; e.g., communication, teamwork, leadership and service, demonstrating responsibility (safety and accountability).

Career-specific competencies relate to a particular strand. These competencies build daily living skills at the introductory levels and support the smooth transition to the workplace and/or post-secondary programs at the intermediate and advanced levels.

The model below shows the relationship of the two types of competencies within the 22 strands of the CTS program.



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BASIC COMPETENCIES REFERENCE GUIDE

The chart below outlines basic competencies that students endeavour to develop and enhance in each of the CTS strands and modules. Students' basic competencies should be assessed through observations involving the student, teacher(s), peers and others as they complete the requirements for each module. In general, there is a progression of task complexity and student initiative as outlined in the Developmental Framework★. **As students progress through Stages 1, 2, 3 and 4 of this reference guide, they build on the competencies gained in earlier stages.** Students leaving high school should set themselves a goal of being able to demonstrate Stage 3 performance.

Suggested strategies for classroom use include:

- having students rate themselves and each other
- using in reflective conversation between teacher and student
- highlighting areas of strength
- tracking growth in various CTS strands
- highlighting areas upon which to focus
- maintaining a student portfolio.

Stage 1— *The student:*	**Stage 2**— *The student:*	**Stage 3**— *The student:*	**Stage 4**— *The student:*
Managing Learning			
☐ comes to class prepared for learning	☐ ——→——→	☐ ——→——→	☐ ——→——→
☐ follows basic instructions, as directed	☐ follows instructions, with limited direction	☐ follows detailed instructions on an independent basis	☐ ——→——→
	☐ sets goals and establishes steps to achieve them, with direction	☐ sets clear goals and establishes steps to achieve them	☐ demonstrates self-direction in learning, goal setting and goal achievement
☐ acquires specialized knowledge, skills and attitudes	☐ applies specialized knowledge, skills and attitudes in practical situations	☐ transfers and applies specialized knowledge, skills and attitudes in a variety of situations	☐ transfers and applies learning in new situations; demonstrates commitment to lifelong learning
☐ identifies criteria for evaluating choices and making decisions	☐ identifies and applies a range of effective strategies for solving problems and making decisions	☐ uses a range of critical thinking skills to evaluate situations, solve problems and make decisions	☐ thinks critically and acts logically to evaluate situations, solve problems and make decisions
☐ uses a variety of learning strategies	☐ explores and uses a variety of learning strategies, with limited direction	☐ selects and uses effective learning strategies	☐ ——→——→
		☐ cooperates with others in the effective use of learning strategies	☐ provides leadership in the effective use of learning strategies
Managing Resources			
☐ adheres to established timelines; uses time/schedules/planners effectively	☐ creates and adheres to timelines, with limited direction; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines on an independent basis; prioritizes task; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines; uses time/schedules/planners effectively; prioritizes tasks on a consistent basis
☐ uses information (material and human resources), as directed	☐ accesses and uses a range of relevant information (material and human resources), with limited direction	☐ accesses a range of information (material and human resources), and recognizes when additional resources are required	☐ uses a wide range of information (material and human resources) in order to support and enhance the basic requirement
☐ uses technology (facilities, equipment, supplies), as directed, to perform a task or provide a service	☐ uses technology (facilities, equipment, supplies), as appropriate, to perform a task or provide a service, with minimal assistance and supervision	☐ selects and uses appropriate technology (facilities, equipment, supplies) to perform a task or provide a service on an independent basis	☐ recognizes the monetary and intrinsic value of managing technology (facilities, equipment, supplies)
☐ maintains, stores and/or disposes of equipment and materials, as directed	☐ maintains, stores and/or disposes of equipment and materials, with limited assistance	☐ maintains, stores and/or disposes of equipment and materials on an independent basis	☐ demonstrates effective techniques for managing facilities, equipment and supplies
Problem Solving and Innovation			
☐ participates in problem solving as a process ☐ learns a range of problem-solving skills and approaches	☐ identifies the problem and selects an appropriate problem-solving approach, responding appropriately to specified goals and constraints	☐ thinks critically and acts logically in the context of problem solving	☐ identifies and resolves problems efficiently and effectively
☐ practices problem-solving skills by responding appropriately to a clearly defined problem, specified goals and constraints, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ applies problem-solving skills to a directed or a self-directed activity, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ transfers problem-solving skills to real-life situations, by generating new possibilities ☐ prepares implementation plans ☐ recognizes risks	☐ identifies and suggests new ideas to get the job done creatively, by: – combining ideas or information in new ways – making connections among seemingly unrelated ideas – seeking out opportunities in an active manner

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Stage 1— *The student:*	**Stage 2**— *The student:*	**Stage 3**— *The student:*	**Stage 4**— *The student:*
Communicating Effectively			
☐ uses communication skills; e.g., reading, writing, illustrating, speaking	☐ communicates thoughts, feelings and ideas to justify or challenge a position, using written, oral and/or visual means	☐ prepares and effectively presents accurate, concise, written, visual and/or oral reports providing reasoned arguments	☐ negotiates effectively, by working toward an agreement that may involve exchanging specific resources or resolving divergent interests
☐ uses language in appropriate context	☐ uses technical language appropriately	☐ encourages, persuades, convinces or otherwise motivates individuals	☐ negotiates and works toward a consensus
☐ listens to understand and learn	☐ listens and responds to understand and learn	☐ listens and responds to understand, learn and teach	☐ listens and responds to understand, learn, teach and evaluate
☐ demonstrates positive interpersonal skills in selected contexts	☐ demonstrates positive interpersonal skills in many contexts	☐ demonstrates positive interpersonal skills in most contexts	☐ promotes positive interpersonal skills among others
Working with Others			
☐ fulfills responsibility in a group project	☐ →	☐ seeks a team approach, as appropriate, based on group needs and benefits; e.g., idea potential, variety of strengths, sharing of workload	☐ leads, where appropriate, mobilizing the group for high performance
☐ works collaboratively in structured situations with peer members	☐ cooperates to achieve group results	☐ works in a team or group: – encourages and supports team members – helps others in a positive manner – provides leadership/followership as required – negotiates and works toward consensus as required	☐ understands and works within the context of the group
☐ acknowledges the opinions and contributions of others in the group	☐ maintains a balance between speaking, listening and responding in group discussions ☐ respects the feelings and views of others		☐ prepares, validates and implements plans that reveal new possibilities
Demonstrating Responsibility			
Attendance			
☐ demonstrates responsibility in attendance, punctuality and task completion	☐ →	☐ →	☐ →
Safety			
☐ follows personal and environmental health and safety procedures	☐ recognizes and follows personal and environmental health and safety procedures	☐ establishes and follows personal and environmental health and safety procedures	☐ transfers and applies personal and environmental health and safety procedures to a variety of environments and situations
☐ identifies immediate hazards and their impact on self, others and the environment	☐ identifies immediate and potential hazards and their impact on self, others and the environment	☐ →	☐ →
☐ follows appropriate/emergency response procedures	☐ →	☐ →	☐ →
			☐ demonstrates accountability for actions taken to address immediate and potential hazards
Ethics			
☐ makes personal judgements about whether or not certain behaviours/actions are right or wrong	☐ assesses how personal judgements affect other peer members and/or family; e.g., home and school	☐ assesses the implications of personal/group actions within the broader community; e.g., workplace	☐ analyzes the implications of personal/group actions within the global context
			☐ states and defends a personal code of ethics as required

***Developmental Framework** • *Simple task* • *Structured environment* • *Directed learning*	• *Task with limited variables* • *Less structured environment* • *Limited direction*	• *Task with multiple variables* • *Flexible environment* • *Self-directed learning, seeking assistance as required*	• *Complex task* • *Open environment* • *Self-directed/self-motivated*

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MECHANICS

B. STRAND RATIONALE AND PHILOSOPHY

The movement of people and goods from one place to another has always been important to human existence. Over the last century, significant advances in modes of transportation have dramatically altered the way we live and make our living. However, the quick and convenient movement of people and goods is not risk free. The ever-increasing use of motor vehicles throughout the world and their reliance on fossil fuels has created major personal safety and environmental concerns. Because the transportation industry is large and diverse, there are many opportunities for rewarding careers, whether it is to design and build safer and more efficient vehicles or to service the ones that are already in use.

In Mechanics, a strand of Career and Technology Studies, students, through hands-on experiences, have the opportunity to increase their knowledge and skills related to the design and maintenance of transportation vehicles, and the impact they have on the environment and on their economic and social well-being. Whether a student plans to prepare for a work-related role in the industry or simply wants to be an informed owner/operator of a vehicle, the Mechanics strand should be viewed as an educational opportunity for all secondary students.

More specifically, the Mechanics strand will provide students with a broad base of experience and knowledge of systems related to the transportation field. Within the philosophy of Career and Technology Studies, ***students*** in Mechanics *will*:

- develop the knowledge, skills and attitudes within the context of the school and the community to achieve success in personal and work life
- apply effective and responsible decision-making strategies to the design, service and repair of transportation vehicles
- link the knowledge, skills and attitudes developed in other courses in meaningful and practical ways to the field of mechanics
- demonstrate flexibility, cooperative work behaviours and effective communication and leadership skills
- link theory and practice, using available resources, tools and materials responsibly, safely and efficiently
- develop estimating and reporting skills
- become better informed consumers

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- develop manual and technological skills
- exercise safe work and environmental practices
- expand personal knowledge and appreciation of further education and career options, and opportunities related to the transportation industry
- determine the economic significance of the transportation industry in the local, national and global community.

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STRAND ORGANIZATION

The Mechanics curriculum development model below has been developed around four themes, which relate specifically to the design, operation and care of transportation vehicles. These themes are integrated by a number of common topics, which provide a basic framework for study in each module. The context in which the learning takes place will vary according to the experience and intent of the learner. For example, the student might be interested in vehicle ownership and/or in the preparation for the workplace. As the learner is engaged in the learning activities, specific outcomes are anticipated. These outcomes take the form of basic, career-specific and personal goals.

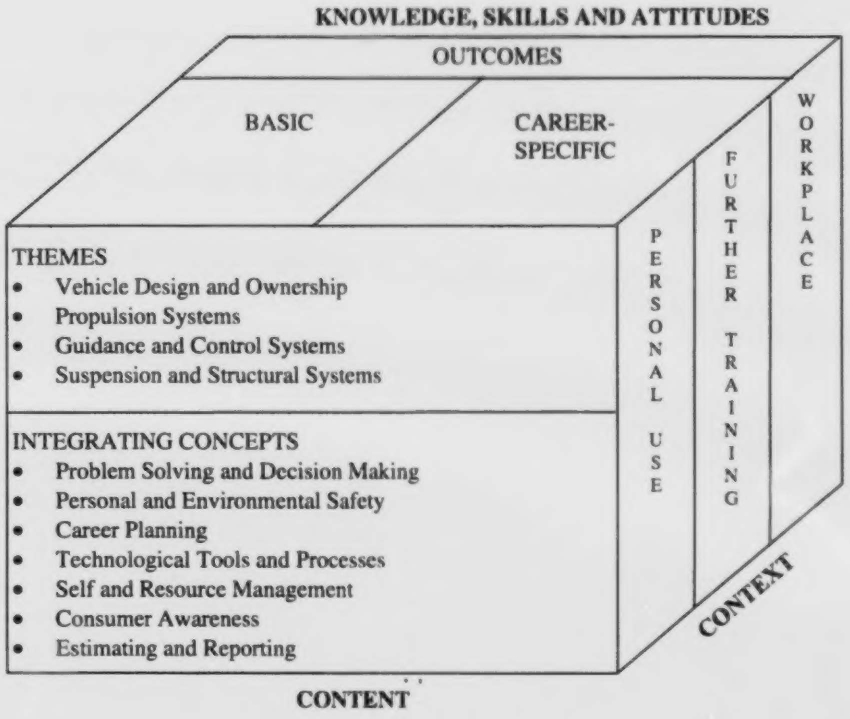
THEMES

Each level of Mechanics has major themes on which modules have been developed:

- Vehicle Design and Ownership
- Propulsion Systems
- Guidance and Control Systems
- Suspension and Structural Systems.

INTEGRATING CONCEPTS

Integrating concepts, shown on the model, provide a basic framework for the study of each module. The context varies according to resources available and interest and intent of the student after completing modules in the strand.


KNOWLEDGE, SKILLS AND ATTITUDES
OUTCOMES
BASIC
CAREER-SPECIFIC
WORKPLACE
FURTHER TRAINING
PERSONAL USE
THEMES
• Vehicle Design and Ownership
• Propulsion Systems
• Guidance and Control Systems
• Suspension and Structural Systems
INTEGRATING CONCEPTS
• Problem Solving and Decision Making
• Personal and Environmental Safety
• Career Planning
• Technological Tools and Processes
• Self and Resource Management
• Consumer Awareness
• Estimating and Reporting
CONTEXT
CONTENT

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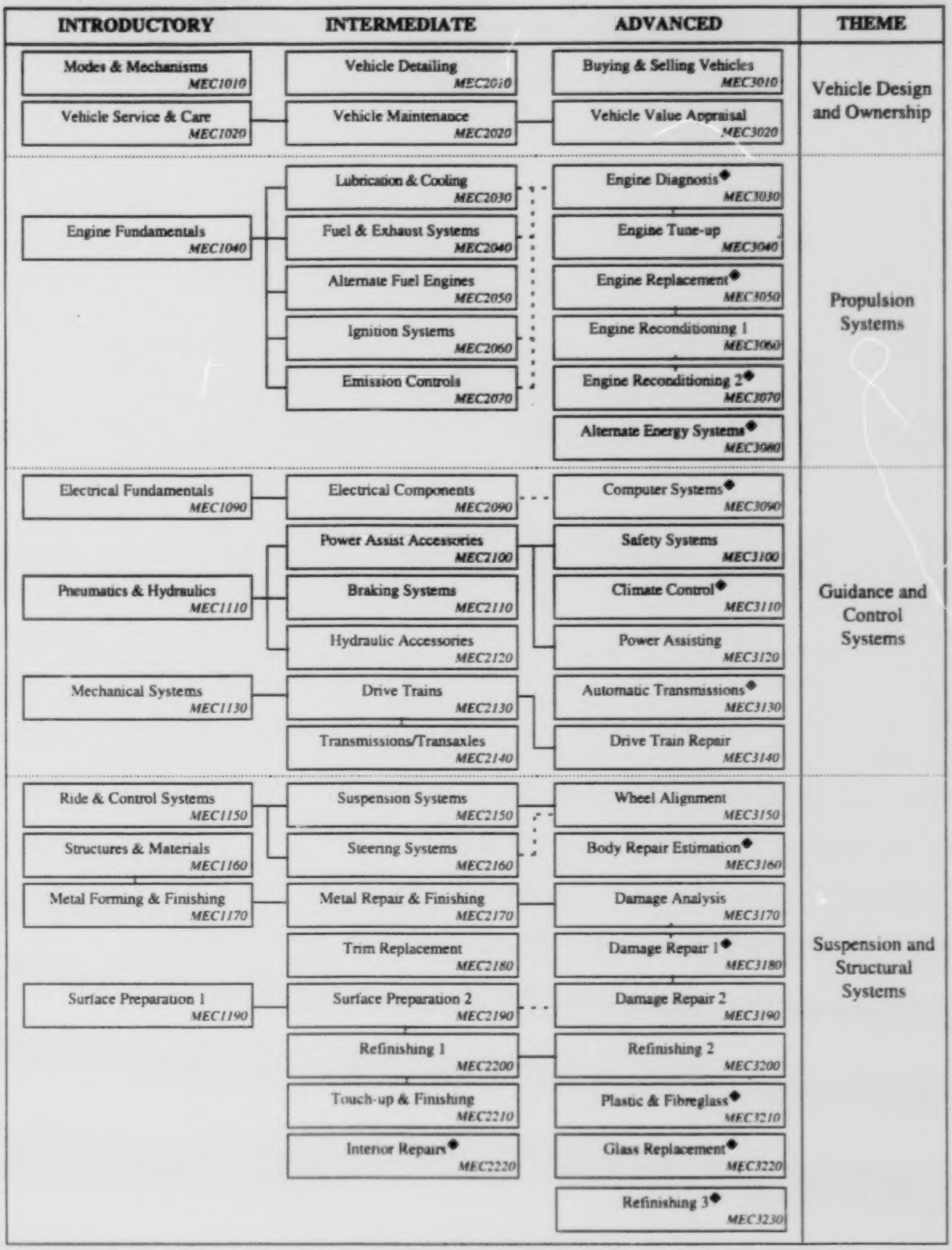

INTRODUCTORY	INTERMEDIATE	ADVANCED	THEME
Modes & Mechanisms *MEC1010*	Vehicle Detailing *MEC2010*	Buying & Selling Vehicles *MEC3010*	Vehicle Design and Ownership
Vehicle Service & Care *MEC1020*	Vehicle Maintenance *MEC2020*	Vehicle Value Appraisal *MEC3020*	
	Lubrication & Cooling *MEC2030*	Engine Diagnosis◆ *MEC3030*	Propulsion Systems
Engine Fundamentals *MEC1040*	Fuel & Exhaust Systems *MEC2040*	Engine Tune-up *MEC3040*	
	Alternate Fuel Engines *MEC2050*	Engine Replacement◆ *MEC3050*	
	Ignition Systems *MEC2060*	Engine Reconditioning 1 *MEC3060*	
	Emission Controls *MEC2070*	Engine Reconditioning 2◆ *MEC3070*	
		Alternate Energy Systems◆ *MEC3080*	
Electrical Fundamentals *MEC1090*	Electrical Components *MEC2090*	Computer Systems◆ *MEC3090*	Guidance and Control Systems
	Power Assist Accessories *MEC2100*	Safety Systems *MEC3100*	
Pneumatics & Hydraulics *MEC1110*	Braking Systems *MEC2110*	Climate Control◆ *MEC3110*	
	Hydraulic Accessories *MEC2120*	Power Assisting *MEC3120*	
Mechanical Systems *MEC1130*	Drive Trains *MEC2130*	Automatic Transmissions◆ *MEC3130*	
	Transmissions/Transaxles *MEC2140*	Drive Train Repair *MEC3140*	
Ride & Control Systems *MEC1150*	Suspension Systems *MEC2150*	Wheel Alignment *MEC3150*	Suspension and Structural Systems
Structures & Materials *MEC1160*	Steering Systems *MEC2160*	Body Repair Estimation◆ *MEC3160*	
Metal Forming & Finishing *MEC1170*	Metal Repair & Finishing *MEC2170*	Damage Analysis *MEC3170*	
	Trim Replacement *MEC2180*	Damage Repair 1◆ *MEC3180*	
Surface Preparation 1 *MEC1190*	Surface Preparation 2 *MEC2190*	Damage Repair 2 *MEC3190*	
	Refinishing 1 *MEC2200*	Refinishing 2 *MEC3200*	
	Touch-up & Finishing *MEC2210*	Plastic & Fibreglass◆ *MEC3210*	
	Interior Repairs◆ *MEC2220*	Glass Replacement◆ *MEC3220*	
		Refinishing 3◆ *MEC3230*	

——— Prerequisite . . . . Recommended sequence

◆Refer to specific modules for additional prerequisites.

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MODULE DESCRIPTIONS

Module MEC1010: Modes & Mechanism
Students research, design, build and test a model of a transportation vehicle, using a simple power source, common materials and tools.

Module MEC1020: Vehicle Service & Care
Students develop knowledge, skills and attitudes to care for and service a motor vehicle.

Module MEC1040: Engine Fundamentals
Students investigate and describe operating principles, construction and applications of engines.

Module MEC1090: Electrical Fundamentals
Students identify and describe the operating principles and applications of electricity.

Module MEC1110: Pneumatics & Hydraulics
Students identify and describe the operating principles and applications of pneumatic and hydraulic systems.

Module MEC1130: Mechanical Systems
Students identify and describe the operating principles and applications of mechanisms used to transmit and control mechanical energy.

Module MEC1150: Ride & Control Systems
Students develop a basic knowledge of ride and control systems associated with vehicles.

Module MEC1160: Structures & Materials
Students identify the types of materials and components used in vehicle construction.

Module MEC1170: Metal Forming & Finishing
Students repair and re-form damaged metal panels.

Module MEC1190: Surface Preparation 1
Students assess the state of a painted surface, and use appropriate restoration procedures.

Module MEC2010: Vehicle Detailing
Students develop the skills required to restore and enhance the exterior finishes of a vehicle.

Module MEC2020: Vehicle Maintenance
Students perform the basic service requirements necessary to ensure adequate maintenance of a motor vehicle.

Module MEC2030: Lubrication & Cooling
Students diagnose, maintain and service the lubrication and cooling systems of a typical four-cycle gasoline engine.

Module MEC2040: Fuel & Exhaust Systems
Students diagnose, maintain and service the fuel and exhaust system of a typical four-cycle gasoline engine.

Module MEC2050: Alternate Fuel Engines
Students determine alternate fuels used to power motor vehicles.

Module MEC2060: Ignition Systems
Students identify the basic components and parts of ignition systems used on internal combustion engines, and service and repair an ignition system.

Module MEC2070: Emission Controls
Students describe the importance of controlling emissions and the technology applied to vehicles to meet prescribed standards.

Module MEC2090: Electrical Components
Students identify and describe the basic use and testing of the electrical components of a typical motor vehicle.

Module MEC2100: Power Assist Accessories
Students identify and explain the function of components and parts of power assist accessories.

Module MEC2110: Braking Systems
Students develop the necessary knowledge, skills and attitudes to diagnose, service and maintain a braking system according to accepted trade practices.

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Module MEC2120: Hydraulic Accessories
Students develop a basic knowledge of hydraulic components, applications and servicing techniques.

Module MEC2130: Drive Trains
Students identify the purpose, describe the operation and perform the servicing of a vehicle drive train.

Module MEC2140: Transmissions/Transaxles
Students perform inspection service and repair procedures on manual transmissions, transaxles and clutch assemblies.

Module MEC2150: Suspension Systems
Students develop the knowledge, skills and attitudes necessary to service and maintain vehicle suspension systems.

Module MEC2160: Steering Systems
Students develop the knowledge, skills and attitudes necessary to maintain a steering system.

Module MEC2170: Metal Repair & Finishing
Students analyze and repair metal damage.

Module MEC2180: Trim Replacement
Students demonstrate the removal and repair of trim parts, with an emphasis on removal and installation without damage.

Module MEC2190: Surface Preparation 2
Students perform advanced surface preparations.

Module MEC2200: Refinishing 1
Students demonstrate metal surface refinishing procedures.

Module MEC2210: Touch-up & Finishing
Students determine and use the appropriate materials, tools and processes for minor surface repairs.

Module MEC2220: Interior Repairs
Students search for and use the appropriate products and techniques to maintain vehicle interior surface materials.

Module MEC3010: Buying & Selling Vehicles
Students develop the skills required to make an informed purchase or sale of a vehicle.

Module MEC3020: Vehicle Value Appraisal
Students demonstrate the procedures used by industry to estimate the cost of a repair and the market value of a vehicle.

Module MEC3030: Engine Diagnosis
Students learn to diagnose the condition of an engine for worn or damaged parts and/or improper adjustments.

Module MEC3040: Engine Tune-up
Students diagnose, service and repair engine, fuel, ignition, charging and starting systems.

Module MEC3050: Engine Replacement
Students remove and install an engine in a chassis.

Module MEC3060: Engine Reconditioning 1
Students determine the need for service, and perform the required service, on the cylinder head and related components of an engine.

Module MEC3070: Engine Reconditioning 2
Students determine the need for service, and perform service, on a cylinder block assembly and related components of an engine.

Module MEC3080: Alternate Energy Systems
Students describe why vehicle manufacturers continue to build the crank-piston internal combustion gasoline engine. Students also identify and describe future engine designs.

Module MEC3090: Computer Systems
Students provide an overview of the applications of computer management systems used in modern vehicles.

Module MEC3100: Safety Systems
Students describe how safety systems can be tested, diagnosed, replaced or repaired.

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Module MEC3110: Climate Control
Students expand their knowledge of the purpose, operation and servicing of standard heating and air conditioning systems.

Module MEC3120: Power Assisting
Students further develop their knowledge of the purpose, operation, service and repair of pneumatic, hydraulic and electric power assist devices.

Module MEC3130: Automatic Transmissions
Students develop knowledge of automatic transmissions and transaxles, and skills in diagnosing and executing minor automatic transmission and transaxle repair requirements.

Module MEC3140: Drive Train Repair
Students perform overhauls on clutch, transmission and differential assemblies.

Module MEC3150: Wheel Alignment
Students develop the knowledge, skills and attitudes necessary for repairing and aligning various vehicle steering systems.

Module MEC3160: Body Repair Estimation
Students apply knowledge in estimating, including close attention to detail in determining the cost of a repair.

Module MEC3170: Damage Analysis
Students identify and examine physical damage caused by collisions, and learn cost estimating procedures.

Module MEC3180: Damage Repair 1
Students examine the methods used to complete a repair involving removing, replacing and aligning of body parts.

Module MEC3190: Damage Repair 2
Students examine methods used to complete a collision repair involving unibody parts replacement and frame correction.

Module MEC3200: Refinishing 2
Students demonstrate finishing skills and techniques related to the preparation and application of metallic paints.

Module MEC3210: Plastic & Fibreglass
Students determine the types of plastic and fibreglass materials required for repairs, and perform appropriate repair procedures.

Module MEC3220: Glass Replacement
Students demonstrate knowledge, skills and practice related to vehicle glass installation and adjustment.

Module MEC3230: Refinishing 3
Students demonstrate knowledge and skills of advanced finishing techniques, including custom painting, mixing, tinting, colour and texture matching.

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SECTION C: PLANNING FOR INSTRUCTION

The Mechanics curriculum framework helps ensure that students do not repeat content. Schools and teachers have maximum flexibility to design programs based on the needs and interests of their students and circumstances in the school and community. The levels framework will challenge secondary students to keep learning and will provide new and exciting opportunities at each level.

PLANNING FOR CTS

Defining Courses

Schools determine which strands and modules will be offered in a particular school, and will combine modules into courses.

Each module was designed for approximately 25 hours of instruction. However, this time frame is only a guideline to facilitate planning. The CTS curricula are competency based, and the student may take more or less time to gain the designated competencies within each module.

A course will usually consist of modules primarily from the same strand but, where appropriate, may include modules from other CTS strands. Refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 4) for more information on course names and course codes.

Module selection and sequencing must consider the module parameters, which define:

- prerequisite and corequisites (entry-level competencies)
- instructional qualifications, if specialized. When student are engaging modules that include tasks performed on road-licenced vehicles, tasks such as brakes, steering and suspension require supervision by a journeyman. Students seeking articulation with trade apprenticeship must be taught/supervised by someone with journeyman status
- equipment and facility requirements, if specialized.

The module parameters are defined for each module, in Sections D, E and F of this Guide.

Degree of Flexibility

The CTS program, while designed using the modular structure to facilitate flexible timetabling and instructional delivery, does not mandate the degree of flexibility a school or teacher will offer. The teacher and school will determine the degree of flexibility available to the student. Within the instructional plan established by the school, the student may:

- be given the opportunity to progress at a rate that is personally challenging
- have increased opportunity to select modules that develop competencies he or she finds most relevant.

Integrating Basic Competencies

The basic competencies relate to managing learning and resources, problem solving and innovation, communicating effectively, working with others and demonstrating responsibility are developed throughout the CTS program, and are within each module.

Assessment of student achievement on the basic competencies is integrated throughout the other module learner expectations. Refer to Section G (Assessment Tools) of this Guide for the description of student behaviours expected at each of the four developmental stages defined for the basic competencies.

Assessment of basic competencies could include input and reflection involving the student, teacher(s), peers and others. Description of the observed behaviour could be provided through a

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competency profile for the module. Positive, ongoing interaction between the student and teacher will support motivation for student growth and improvement.

The basic competencies related to safety, service teamwork and accountability should be emphasized in Mechanics modules, particularly at the advanced level where industry-based activities and projects would be appropriate.

Although no mark would be assigned to the student's performance in the designated basic competencies, observations of performance should be included within the assessment of each module.

Assessing Student Achievement

Assessing the student's competency is a process of gathering information by way of observations of process, product and student interaction.

Where appropriate, assessment tools have been defined to assist the teacher and student in the assessment. Refer to Section G (Assessment Tools) of this Guide for copies of the various tools (worksheets, checklists, sample questions, etc.).

A suggested emphasis for each module learner expectation has also been established. The suggested emphasis provides a guideline to help teachers determine time allocation and/or the appropriate emphasis for each MLE and student grade.

Recognizing Student Achievement

At the high school level, successful demonstration of the exit-level competencies in a module qualifies the student for one credit. Refer to Section A of this Guide for more detailed information about how curriculum and assessment standards are defined in CTS. Refer to the *Career & Technology Standards Manual for Administrators, Counsellors and Teachers* (Appendix 12) for more information on how student achievement can be recognized and reported at the school and provincial levels.

Portfolios

When planning for instruction and assessment, consider a portfolio as an excellent tool to provide evidence of a student's effort, progress and achievement. Portfolios will aid students in identifying skills and interest. They also provide the receiving teacher, employer and/or post-secondary institution proof of a student's accomplishments. The make-up and evaluation of the portfolio should be a collaborative agreement between the student and teacher.

Resources

A comprehensive resource base, including print, software and audio-visual has been identified to support the Mechanics strand. It is intended that these resources form the basis of a resource centre, encouraging teachers and students to access a wide selection of resources and other information sources throughout the learning process. Unless otherwise noted, these resources are considered to be suitable for both junior and senior high school students.

Authorized resources may be obtained from the Learning Resources Distributing Centre or directly from the publisher or distributor. Refer to Section I (Learning Resources Guide) for the complete resource list including curriculum correlations and resource annotations. Additional sources refer to noncommercial or government agencies that offer resources that may be of assistance in this strand.

Sample Student Learning Guides

In addition to the resources, Sample Student Learning Guides are available (refer to Section J of this Guide). These samples, designed for individual student or small group use, provide an instructional plan for selected modules and include the following components:

- Why take this module?
- What are the entry-level competencies?
- What are the exit-level competencies?
- What resources may be accessed?
- What assignments/activities must be completed?
- What are the timelines?
- How will the final mark be calculated?

Sample Student Learning Guides have been developed for the following modules in Mechanics:

- Modes & Mechanisms
- Vehicle Detailing.

PLANNING FOR MECHANICS

The following suggestions are provided to assist teachers and school and school system administrators as they plan to deliver modules from the Mechanics strand.

Safety

In Career and Technology Studies, health and safety are given a high priority. Teachers of the Mechanics program should make every effort to provide a safe environment for students. Teachers should also have knowledge of safety hazards in the program and how best to minimize, health and safety problems.

In Mechanics, when students perform tasks on road-licenced vehicles pertaining to brakes steering and suspension, the students must be supervised by a journeyman technician. These tasks can be performed on shop units when the instructional qualifications cannot be met. For specific safety concerns refer to module specific learner expectations relating to safety.

Related Legislation

The Mechanics strand delivers many of the competencies that exist in the following Alberta compulsory trade areas: Auto Body Technician, Automotive Service Technician Heavy Equipment Technician, Motorcycle Mechanic and in the optional trade area of Agriculture Mechanics.

The *Alberta Apprenticeship and Industry Training Act* provides detailed explanations regarding the delivery of apprenticeship programs in Alberta. The Act specifically addresses who can or cannot work in compulsory and optional trade areas. It states: *A person shall not work in a compulsory or optional trade area unless that person:*

a. holds a trade certificate
b. is an apprentice in the specified trade
c. is authorized under Section 23 to work or perform one or more tasks in the trade
d. is a student in a student work training program in that trade.

In addition, a person who does not hold a trade certificate in an optional certificated trade area may work in or perform one or more tasks, activities or functions if the employer is satisfied that the person possesses the skill and knowledge in the trade as would be expected from one who would be in possession of a trade certificate.

It should be noted that the Act spells out the ratio of journeyman to apprentices, which is a minimum of one apprentice to each journeyman employed. This ruling applies to Registered Apprentice Program students during off-campus learnings.

Instructional Qualifications

Responsibility for instructional planning and delivery of courses in Mechanics will be assumed by Alberta certified teachers having expertise in classroom and mechanic/technician experience. See specific modules for detailed information regarding instructional qualifications. It should also be noted that portions of modules requiring special instructional qualifications can also be delivered through off-campus learnings. Or, module learner outcomes may be accomplished using shop units at which time no journeyman instructional qualifications would be required.

Selecting Modules

The scope and sequence chart in Section B provides an overview of the Mechanics modules, indicating theme areas. Brief descriptions of the modules are in Section B.

Course planning should take into consideration module sequences that link with both physical and human resources present in the school and community.

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Mechanics for Junior High School Students

The introductory level modules may be offered in part on in whole at the junior high level. As available resources in each school and community will vary, it is important to assess potential support networks prior to selecting module sequences.

The number of modules will vary according to the time available throughout Grades 7, 8 and 9:

Time Available	Modules
8 – 25 hours	**Modes & Mechanisms**
50 hours	**Engine Fundamentals** **Mechanical Systems**
75 – 100 hours	*add one or two of the following:* **Vehicle Service & Care** **Electrical Fundamentals** **Structures & Materials** **Metal Forming & Finishing**

Where appropriate, junior high school students may also take intermediate level modules, particularly in the Vehicle Design and Ownership theme.

Modules may be combined into courses and offered within a school year or over a span of a few years.

Mechanics for Senior High School Students

Following are a few examples of module groupings into sample courses:

3 credits (no previous strand experience) with a focus on vehicle ownership	**Vehicle Service & Care** **Vehicle Detailing** **Vehicle Maintenance** **Buying & Selling Vehicles** **Vehicle Value Appraisal**
3 credits (strong background from junior high school) with a focus on the automobile	**Electrical Fundamentals** **Ride & Control Systems** **Structures & Materials** **Vehicle Maintenance**
5 – 10 credits (foundation for workplace/ post-secondary entry in technical/ support positions involving motor vehicles	**Lubrication & Cooling** **Fuel & Exhaust Systems** **Ignition Systems** **Electrical Components** **Braking Systems** **Drive Trains** **Transmissions/Transaxles** **Suspension Systems** **Steering Systems** **Engine Diagnosis**
5 – 10 credits (foundation for entry into post-secondary programs in Autobody)	**Metal Forming & Finishing** **Surface Preparation 1** **Metal Repair & Finishing** **Surface Preparation 2** **Refinishing 1** **Touch-up & Finishing** **Body Repair Estimation** **Damage Analysis** **Damage Repair 1** **Damage Repair 2** **Refinishing 2**

Modules could also be grouped into comprehensive courses that develop competencies relevant to career paths within a specific industry.

Organizing for Learning

A "learn by doing" approach is recommended for the Mechanics strand. Essentially, the teacher's role will become that of guide and partner in the learning process. The "learn by doing" approach requires the teacher to be facilitator and coach, rather than subject-based expert, as students actively participate in learning by doing and discovering.

Small group instruction is a good way to foster learning by doing and discovering. Small groups enable students to be active participants in learning, and develop independent and responsible learning habits. As students work in small group situations they will share information, solve problems, develop consensus, and help each other learn content and processes.

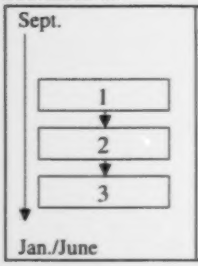
The community is a major stakeholder in education and can be an effective partner in the learning process. The use of community members and resources should be integrated into course planning. Business, industry and government agencies offer a wide range of services and resources, as do local clubs, service groups and institutions. When planning for the use of community resources, teachers should ensure that related presentations and/or activities:

- are consistent with student knowledge and skill levels
- demonstrate sound pedagogy
- are exemplary of approved health and safety standards
- provide a balanced approach to curriculum topics and related issues.

Prior to selecting modules, teachers should check the module parameters outlined in each module (see Sections D, E and F of this Guide). These module parameters, in addition to identifying prerequisite or corequisite modules, assist in identifying community partners and resources when required.

Modules can be delivered sequentially, concurrently or combined. For example, if an instructional block of safety is desired, the safety aspects of several modules could be combined.

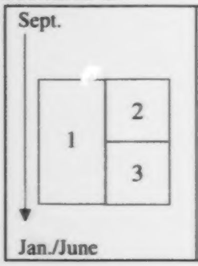
Scenario A



Modules are taught sequentially, e.g.:

Engine Fundamentals
↓
Lubrication & Cooling
↓
Fuel & Exhaust Systems

Scenario B

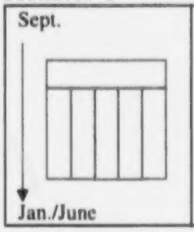


One module, such as Vehicle Maintenance, is taught throughout the course (e.g., 20 minutes per class), in conjunction with two other modules.

1 = Vehicle Maintenance
2 = Braking Systems
3 = Suspension Systems

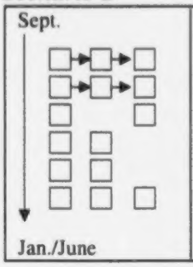
Teachers can also allow students to progress at a rate that is personally challenging.

Scenario C



All students take one or two modules together, and are then allowed to select modules from an open list of modules.

Scenario D



Students select individual modules from a list of modules selected by the teacher. In consultation with the teacher, students then establish timelines for the completion and submission of assignments, etc.

Plans for instruction must address social, economic and environmental perspectives related to resource development. Provide opportunities for students to become involved in learning experiences that reflect a broad understanding of related issues and alternatives. Presentations of course content that reflect a singular or narrow view of mechanics are not consistent with learner expectations and must be avoided.

As in all CTS strands, students will identify, explore and prepare for future career opportunities. It is recommended that course planning include the integration of relevant career investigations throughout each module, rather than as a singular or isolated study. Career profiles, interviews and job shadowing will acquaint students with the many technical and professional careers associated with the mechanics field.

Addressing Safety in Off-campus Excursions

Field excursions are recommended and should be an important part of teaching and learning throughout the Mechanics strand. Safety must be a prime consideration in planning off-campus learning experiences. Both teachers and students should engage in activities commensurate with their level of training and ability. Adequate instructional support, guidance and supervision must be provided at all times. Local jurisdiction and school policies must be understood and observed by principals, teachers, parents, supervisors and students.

Preparation and Risk Anticipation

The preparation stage is the most important part of any off-campus excursion. At this stage of planning, potential risks can be anticipated and either avoided or moderated. The preparation stage should focus attention on:

- trip administration, including the use of parental permission forms, health information forms, school/system authorization forms and accident report forms
- a review of laws and regulations relevant to the excursion and activities that will be undertaken
- study of the site to which the trip is being conducted, and the identification of potential hazards and risks
- determination of group size and the level of supervision that will be required (i.e., supervisor–student ratio)
- a briefing of parents, school administrators, government/industry authorities or others who should be informed in the event of an accident regarding itineraries, participants and emergency response plans
- pre-trip logistics, including transportation, equipment, facility and departure date considerations
- student preparation, including background knowledge and experience, medical problems and/or needs, mental and physical preparedness, and training in specific skill areas.

On-site Risk Management

Safety and risk management involves exercising situation-specific judgement throughout the course of an off-campus excursion. Judgement is the product of experience, and may include recognizing factors such as dangers imposed by equipment, a decline in physical strength, or a more challenging task. Many of the hazard recognition skills can be taught in the classroom in the preparation stage.

A significant aspect of on-site risk management is group management. Teachers can exercise appropriate group management strategies by focusing attention on:

- pacing and observation distance, including speed of travel, rest stops, distance travelled and maintaining safe distance for observations
- group control, including position of leader, regrouping procedures, signal systems and buddy systems
- the establishment of group rules and norms
- clearly defined task allocations for each student
- objective hazard recognition on the site, including machinery and equipment.

Identifying Linkages

Section H of this Guide describes linkages within CTS strands.

Note that project modules from the Career Transitions strand may be combined with modules from Mechanics to provide increased opportunity for students to develop expertise and refine their competencies. For example, students who have completed Engine Fundamentals (MEC1040) may need to add to their background experience prior to taking the advanced level engine reconditioning modules. In situations like this, students could be asked to do a project module related to engines to enhance their competencies. Project modules are **not** designed to be offered as distinct courses and should **not** be used to extend Work Experience 15, 25 and 35 courses.

Improving Smooth Transitions to the Workplace and/or Post-secondary Programs

To assist students in making smooth transitions, consideration should be given to the development of a portfolio which would facilitate a prior learning assessment.

Refer to Section H of this Guide for potential transitions students may make into:

- the workplace
- related post-secondary programs or other avenues for further learning.

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION D: INTRODUCTORY LEVEL

The following pages define the curriculum and assessment standards for the introductory level of Mechanics.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are developed for students who have no previous experience in the strand.

Module learner expectations define the competencies a student must demonstrate to achieve success in a module. Assessment standards define the criteria and conditions to be used for assessing the competencies defined in the module learner expectations.

Specific learner expectations provide a detailed framework for instruction to help students build the competencies defined in the module learner expectations. Additional information and suggestions for instruction are provided in the Notes column; teachers may wish to use this space to record their ideas for instruction or student projects.

Module MEC1010: Modes & Mechanisms D.3
Module MEC1020: Vehicle Service & Care D.7
Module MEC1040: Engine Fundamentals D.13
Module MEC1090: Electrical Fundamentals D.17
Module MEC1110: Pneumatics & Hydraulics D.21
Module MEC1130: Mechanical Systems D.25
Module MEC1150: Ride & Control Systems D.29
Module MEC1160: Structures & Materials D.33
Module MEC1170: Metal Forming & Finishing D.37
Module MEC1190: Surface Preparation 1 .... D.41

MODULE MEC1010: **MODES & MECHANISMS**

Level: Introductory

Theme: Vehicle Design and Ownership

Prerequisite: None

Module Description: Students research, design, build and test a model of a transportation vehicle, using a simple power source, common materials and tools.

Module Parameters: Access to basic hand tools.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools, and follow established lab procedures	• observed performance related to: – following established shop/lab routines – maintaining a safe and tidy workplace – selecting and safely using tools – managing time and resources. *Assessment Tool* *Task Assessment Checklist: Laboratory Practice, Part 1, MEC1010–1* *Standard* *Performance rating of 1 or more on each criteria*	10
• list and describe operating systems and structures common to all modes of transportation	• identification and description of operating systems and structures common to all modes of transportation. *Assessment Tool* *Task Assessment Checklist: Laboratory Practice, Part 2, MEC1010–1* *Standard* *Performance rating of 1 or more on each criteria*	20
• research, design, build and test a concept vehicle	• observed performance related to: – research skills – designed product – built product – testing procedures. *Assessment Tool* *Task Assessment Checklist: Laboratory Practice, Part 3, MEC1010–1* *Standard* *Performance rating of 1 or more on each criteria*	70

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MODULE MEC1010: MODES & MECHANISMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow safety rules and guidelines related to the use of basic hand and power tools • identify the hazards associated with the use of: – compressed gases – liquids under pressure – flammable materials – components under tension.	Discuss personal property and environmental concerns.
Identification/ Function	• identify a transportation mode that can be used to move passengers or goods in the following environments: – terrestrial – marine – atmospheric – space • describe, in a given environment, what forces must be overcome to start and keep a vehicle/craft in motion • list and describe the function of the following systems: – propulsion – guidance – control – suspension – structural – solar and wind	

MODULE MEC1010: MODES & MECHANISMS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • describe and demonstrate how energy is used to produce motion using: – gravity – elastic or spring materials under tension – compressed gases – liquids under pressure – electromagnets – combustion • identify and compare the guidance and control mechanisms that are used in connection with a: – land vehicle – marine craft – aircraft – spacecraft • identify and compare the means by which a vehicle or craft is supported: – on land – in air, water or space • identify the types of structures and materials that are used to support vehicular systems to provide maximum safety and performance.	
Application	• research, design and construct a vehicle or craft for a predetermined use.	Follow design process. Projects depend on the selection of transportation mode and propulsion system. Project examples are: • CO_2 powered craft/ vehicle • solar powered • rubber band powered • battery powered • bottle sockets.

Concept	Specific Learner Expectations	Notes
Testing/Evaluating	*The student should:* • identify an appropriate measurement technique used to assess factors such as: – speed – pulling power – payload – efficiency • describe operation and construction of the transportation vehicle.	Suggest self-evaluation.
Portfolio Development	• show notes, sketches, working drawings, pictures and performance records in a portfolio.	

MODULE MEC1020: **VEHICLE SERVICE & CARE**

Level: Introductory

Theme: Vehicle Design and Ownership

Prerequisite: None

Module Description: Students develop knowledge, skills and attitudes to care for and service a motor vehicle.

Module Parameters: Access to commercially available products and related resources.
Note: Customer work must be checked by qualified technician.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools, and follow established lab procedures	• observed performance related to: – following established shop lab procedures – proper handling of vehicle fluids – safe handling of vehicle cosmetic/cleaning products – maintaining a safe/tidy workplace. *Assessment Tool* *Task Assessment Checklist: Vehicle Service and Care, Part 1, MEC1020–1* *Standard* *Performance rating of 3 on each criteria*	10
• develop a preventive maintenance service schedule for a vehicle	• developed service schedule for a given vehicle considering the following: – items to be checked, serviced or routinely replaced – items to be included are fluids, filters, tires, belts/chains, battery and lights – distance/time intervals and operating conditions. *Assessment Tool* *Task Assessment Checklist: Vehicle Service and Care, Part 2, MEC1020–1* *Standard* *Performance rating of 1 or more on each criteria*	15

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• inspect and service a vehicle according to the vehicle service schedule	• observed performance related to: – completion of service schedule – selection and use of resources – time on task – quality of service. *Assessment Tool* *Task Assessment Checklist: Vehicle Service and Care, Part 3, MEC1020–1* *Standard* *Performance rating of 1 or more on each criteria*	50
• clean and apply a protective coating to the exterior and interior surfaces of a vehicle for use or storage	• observed performance in cleaning and applying protective coatings to a given vehicle, observing the following: – proper selection and use of equipment/materials – quality of completed task – ability to problem solve – time on task. *Assessment Tools* *Task Assessment Checklist: Vehicle Service and Care, Part 4, MEC1020–1* *Standard* *Performance rating of 1 or more on each criteria*	25
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and assessment tools noted above*	Integrated throughout

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MODULE MEC1020: VEHICLE SERVICE & CARE (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow practices that promote safety and protect the environment.	
Consumer Awareness	• explain why preventive maintenance can: – avoid expensive repairs – improve reliability and safety – improve efficiency – extend the life of the vehicle • identify and locate a vehicle's major mechanical and structural components that need regular service and care • identify and safely use common hand tools and equipment • identify from the owner's manual the recommended: – type and grade of motor oil – type of engine coolant – brake fluid – power steering fluid – transmission fluid – type of filters • identify potential trouble signs such as: – warning lights or gauges – unusual odours or noises – burning oil – leaks – other • describe what steps should be taken when a vehicle is stored for a period of time • explain why it is necessary to shelter or protect a vehicle from: – the sun's radiation – salt – heat and cold – other • identify the components of a work order.	

MODULE MEC1020: VEHICLE SERVICE & CARE (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Inspect/Service	• prepare a repair order	Emphasize legal aspects of writing up and signing a work order.
	• demonstrate a visual inspection of: – fluid levels – hose and belt condition – tire pressure and condition – lights and accessories – battery condition – other	Relate to routine battery service.
	• prepare a service schedule using the owner's manual or a shop manual to determine when to: – change lubrication fluids – replace filters – drain and replace coolants – lubricate body components – inspect and lubricate suspension and steering joints – inspect brake linings – repack wheel bearings – rotate tires – other	Should be developed to meet local conditions.
	• demonstrate the procedure used to: – replace engine motor oil, coolant and filters – lubricate chassis and body parts – clean and check the battery condition – rotate tires – check tire pressure – dispose of used fluids and parts – other	
	• identify and demonstrate the use of products that can be safely used to: – clean a painted surface – degrease components – wax and polish a surface – other; e.g., chip protection	For example, head lamp covers, nose guards, mud flaps, side protection moldings.

MODULE MEC1020: VEHICLE SERVICE & CARE (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Service (continued)	*The student should:* • list items to be taken on trips (winter, summer) • remove and replace tire and rim from a vehicle • boost (jump-start) a vehicle • demonstrate basic troubleshooting on a stalled vehicle.	Emergency kit. Practise using vehicle jack and wheel nut wrench. Follow recommended procedure to avoid damage to vehicle or battery explosion.
Careers	• list personal characteristics of a service centre technician • describe further education, working conditions and career opportunities.	

MODULE MEC1040: ENGINE FUNDAMENTALS

Level: Introductory

Theme: Propulsion Systems

Prerequisite: None

Module Description: Students investigate and describe operating principles, construction and applications of engines.

Module Parameters: Access to engine measuring tools, related resources, engine units.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate safe use of tools, and follow established lab procedures**	• observed performance related to: – following established lab procedures – selecting proper tools – demonstrating safe use of tools – recognizing hazards of gasoline and other fuels. *Assessment Tool* *Task Assessment Checklist: Engine Fundamentals, Part 1, MEC1040–1* *Standard* *Performance rating of 2 on each criteria*	10
• **compare operating principles of two- and four-cycle piston engines**	• a report comparing the operating principles of the following engine types: – two-stroke cycle – four-stroke cycle. *Assessment Tool* *Task Assessment Checklist: Engine Fundamentals, Part 2, MEC1040–1* *Standard* *Performance rating of 1 or more on each criteria*	20

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MODULE MEC1040: ENGINE FUNDAMENTALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• determine the condition of an internal combustion engine	• demonstration of problem-solving skills to determine the condition of a given engine by: – using the appropriate resources – determining mechanical condition including compression checks – identifying spark plug voltages and spark timing settings – examining fuel supply to the cylinder – making engine measurements for bore, stroke and displacement. *Assessment Tool* *Task Assessment Checklist: Engine Fundamentals, Part 3, MEC1040–1* *Standard* *Performance rating of 1 or more on each criteria*	60
• describe the by-products of combustion and their impact on the environment	• listing/describing combustion by-products and their impact on the environment, including: – carbon dioxide – carbon monoxide – oxides of nitrogen – particulates. *Assessment Tool* *Task Assessment Checklist: Engine Fundamentals, Part 4, MEC1040–1* *Standard* *Performance rating of 1 or more on each criteria*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and assessment tools noted above*	Integrated throughout

MODULE MEC1040: ENGINE FUNDAMENTALS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures • describe the hazards associated with: – gasoline and other flammable liquids – exhaust gases – hot coolants and liquids.	
Identification/ Function	• identify and use measuring tools in both Imperial and metric systems of measurement, such as: – steel rule – calipers and dividers – micrometer – dial indicator – torque wrench – pressure gauges – other • identify and use fasteners associated with engines (measurements in both imperial and metric), such as: – bolts, studs and nuts – washers – pins – keys – snap rings – machine screws – other • describe the effects of heating a gas in an enclosed space • identify the types of fuels commonly used in combustion engines • describe the by-products of combustion and their effects on personal health and the environment. • describe the difference between an internal and an external combustion engine • identify the type of engines and fuels that are used for air, land, sea and space applications	

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • identify and label the major parts of a reciprocating engine • demonstrate how reciprocating motion is converted to rotary motion • explain the difference between a two- and a four-stroke cycle engine • explain the purpose of the following support systems: – cooling – lubrication – ignition – fuel – exhaust • demonstrate how engines differ according to their: – number of cylinders – design – size – make and model – other • appraise the condition of an engine.	Emphasize purpose only.
Identify/Analyze	• locate and use resources related to: – service bulletins and repair manuals – engine specifications documentation – parts numbers and assembly procedures.	
Careers	• describe further education, working conditions and career opportunities.	

MODULE MEC1090: **ELECTRICAL FUNDAMENTALS**

Level: Introductory

Theme: Guidance and Control Systems

Prerequisite: None

Module Description: Students identify and describe the operating principles and applications of electricity.

Module Parameters: Access to multimeter, battery hydrometer, battery charger, related battery tools, electrical supplies.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of electrical tools and equipment, and follow established lab procedures	• observed performance related to: – following established lab/shop procedures using personal protective equipment, recognizing electrical hazards, proper storage battery handling/service and correct use of electrical meters. *Assessment Tool* *Task Assessment Checklist: Electrical Fundamental, Part 1, MEC1090–1* *Standard* *Performance rating of 1 or more on each criteria*	15
• apply electrical principles and concepts to test electrical circuits and components	• observed performance in: – recognition of series and series parallel circuits on a vehicle – measuring voltages, resistances and current flow in lighting, charging and starting systems – testing a battery. *Assessment Tool* *Task Assessment Checklist: Electrical Fundamentals, Part 2, MEC1090–1* *Standard* *Performance rating of 1 or more on each criteria*	85
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• safely use tools/equipment and follow established lab procedures • identify causes of battery explosion/acid burns • describe electrical shock/burns/fires • outline a plan of action when an accident occurs.	Use face/eye protection when working around batteries.
Identification/ Function	• describe magnetic attraction and repulsion • produce a temporary and permanent magnet • find the polarity of an electromagnet • describe the electron theory in relation to the parts of an atom	
	• describe production of electricity: – chemically – thermally – photoelectrically – piezoelectrically – electromagnetically	Explain how static charges are produced and their effects on a vehicle.
	• explain the difference between AC and DC current. • identify and label the parts of a simple circuit • identify the physical form and circuit symbol of a: – light – motor – heating element – solenoid – fuse – other • describe what conditions create: – an open circuit – a closed circuit – a short circuit – a grounded circuit	

MODULE MEC1090: ELECTRICAL FUNDAMENTALS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • describe how a frame-ground circuit operates on a motor vehicle • define what is meant by: – amperage – voltage – resistance • compare the similarity between electrical and fluid energy.	
Inspect/Service	• construct and compare a series and a parallel circuit • measure, with appropriate meters, the resistance, voltage and amperage in a given circuit • describe the relationship that exists among the amperage, voltage and resistance within a circuit • describe condition of a battery and service.	Develop a working model, block diagrams of lighting, starting charging system. Be aware of the hazards associated with testing and charging a battery
Careers	• identify further education and work opportunities related to servicing electrical circuits and components.	

MODULE MEC1110: PNEUMATICS & HYDRAULICS

Level: Introductory

Theme: Guidance and Control Systems

Prerequisite: None

Module Description: Students identify and describe the operating principles and applications of pneumatic and hydraulic systems.

Module Parameters: Access to related pneumatic/hydraulic units and resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate the safe use of pneumatic and hydraulic tools and equipment, and follow established lab procedures	• observed performance related to: – recognition of dangers involved when working with pressurized pneumatic and hydraulic systems – selection and safe use of tools – clean-up of hydraulic fluids. *Assessment Tool* *Task Assessment Checklist: Pneumatic and Hydraulic Systems, Part 1, MEC1110–1* *Standard* *Performance rating of 2 on each criteria*	10
• compare operating principles of pneumatic and hydraulic systems	• comparing operating principles of pneumatic and hydraulic systems indicating: – identification and description of components – application of systems on vehicles. *Assessment Tool* *Task Assessment Checklist: Pneumatic and Hydraulic Systems, Part 2, MEC1110–1* *Standard* *Performance rating of 1 or more on each criteria*	30
• apply principles and concepts of pneumatics and hydraulics to test and operate a pneumatic and/or hydraulic system	• observed performance in operating and testing one pneumatic and one hydraulic system. *Assessment Tool* *Task Assessment Checklist: Pneumatic and Hydraulic Systems, Part 3, MEC1110–1* *Standard* *Performance rating of 1 or more on each criteria*	60

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: - demonstrate basic competencies.	*Assessment of student achievement should be based on:* - observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* - demonstrate knowledge of and follow laboratory safety procedures - list hazards related to working with fluids and gases under pressure and related equipment.	Serious injury results from inappropriate handling of high pressures in both hydraulic and pneumatics.
Identification/ Function	- state why fluid systems are widely used in transportation and power application - contrast hydraulic and pneumatic systems - demonstrate how pressure affects a liquid and a gas in an enclosed space - describe what units are used to measure pressure in a fluid - describe what units are used to calculate the flow of fluid past a point - demonstrate the relationship between flow rate and pressure in a fluid system - describe how a small force can be multiplied in a fluid system - contrast the action of common pumps and compressors such as: – impeller – gear – piston – diaphragm – vane type - locate examples of these pumps and compressors in a motor vehicle or some other power system	Dismantle shop units to identify components and operating principles.

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • observe and demonstrate the use of valves to control: – direction of flow – pressure of fluids – flow rate of fluids • locate valves on a given vehicle • demonstrate how fluids under pressure can be used to move a: – motor – cylinder – diaphragm • identify and operate pneumatic and hydraulic units on a given vehicle • describe the principles in a fluid system such as: – hydraulic hoist – hydraulic brakes.	Create demonstration units.
Inspect/Repair	• demonstrate how to check and adjust fluid levels • demonstrate how to double and single flare a steel line and indicate when each flare type should be used.	
Careers	• identify further education and work opportunities related to the use and service of pneumatic and hydraulic systems.	

MODULE MEC1130: MECHANICAL SYSTEMS

Level: Introductory

Theme: Guidance and Control Systems

Prerequisite: None

Module Description: Students identify and describe the operating principles and applications of mechanisms used to transmit and control mechanical energy.

Module Parameters: Access to examples of mechanical units and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools, and follow established lab procedures	• observed performance related to: – following established shop/lab routines – proper selection and safe use of tools – use of guards and shields. *Assessment Tool* *Task Assessment Checklist: Mechanical Systems, Part 1, MEC1130–1* *Standard* *Performance rating of 2 on each criteria*	10
• describe principles and concepts related to the use of mechanisms to control and transmit force and motion in a mechanical system	• report listing/describing and providing examples of the following: – simple machines – types of mechanical motion – direct and indirect power transmission units – conversion of mechanical energy. *Assessment Tool* *Task Assessment Checklist: Mechanical Systems, Part 2, MEC1130–1* *Standard* *Performance rating of 1 or more on each criteria*	30

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MODULE MEC1130: MECHANICAL SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• apply basic principles and concepts of mechanical systems	• observed performance on the setup and determination of the following: – torque and gear ratios – mechanical advantage – coefficient of friction. *Assessment Tool* *Task Assessment Checklist: Mechanical Systems, Part 3, MEC1130–1* *Standard* *Performance rating of 1 or more on each criteria*	60
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow laboratory safety procedures • explain dangers associated with rotating/moving components.	Be aware of clothing, hair entanglement.

MODULE MEC1130: MECHANICAL SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identification/ Function	• describe the application of mechanical systems that are found in all aspects of human endeavour	Group activity.
	• demonstrate the use of simple machines to change the: – direction in which a force acts – size of the force – place where the force acts.	
	• identify and describe a mechanism that produces: – linear motion – reciprocating motion – oscillating motion – rotary motion – other	
	• use a graph to describe the action of a cam as it changes rotary motion to linear motion	Consider bicycle drive mechanism and model engines.
	• explain the difference between direct and indirection transmission of power	Use of sample transmissions/rear axles; e.g.: • self-propelled lawn mowers • riding mowers • basic automobile, transmissions, drive shafts, differentials.
	• describe the purpose and types of: – shafts – couplers – universal joints – pins – others	
	• demonstrate the use of simple machines to: – start and stop motion – change directions – increase or decrease speed – increase or decrease torque	
	• describe the relationship between torque, velocity and gear ratios	

MODULE MEC1130: MECHANICAL SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • explain why friction has both positive and negative attributes • compare the coefficient of friction between two different materials • describe how friction can be increased or decreased in a mechanical system • calculate the mechanical advantage of one or more mechanisms to determine the efficiency of the system. • explain how mechanical energy can be changed to: – heat energy – electrical energy – fluid energy – other.	Use/construct unit similar to oil additive demonstration unit.
Inspect/Service	• list, observe and service mechanical systems on a given vehicle.	Service and repair a bicycle, rototiller, garden tractor, etc.

MODULE MEC1150: RIDE & CONTROL SYSTEMS

Level: Introductory

Theme: Suspension and Structural Systems

Prerequisite: None

Module Description: Students develop a basic knowledge of ride and control systems associated with vehicles.

Module Parameters: Access to floor jack, safety stands, suspension/steering system and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools, and follow established lab procedures	• observed performance related to: – following established shop/lab routines – use of floor jack and safety stands. *Assessment Tool* *Task Assessment Checklist: Ride and Control Systems, Part 1, MEC1150–1* *Standard* *Performance rating of 2 on each criteria*	10
• describe the purpose, operation and interdependent nature of ride and control systems	• report showing purpose and operation of suspension, steering and braking system used on land vehicles • report showing how hydraulics, pneumatics and electrical are applied to ride and control systems. *Assessment Tool* *Task Assessment Checklist: Ride and Control Systems, Part 2, MEC1150–1* *Standard* *Performance rating of 1 or more on each criteria*	30
• inspect and service ride and control systems	• observed performance in inspecting/servicing suspension, steering and brake systems including the following: – labelling and checking parts subject to wear – inspecting and repacking a wheel bearing – identifying tire wear problems. *Assessment Tool* *Task Assessment Checklist: Ride and Control Systems, Part 3, MEC1150–1* *Standard* *Performance rating of 1 or more on each criteria*	60

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow established safety procedures.	
Identification/ Function	• locate and identify the components that are used to provide: – stopping action – directional control – rolling action – stabilization – cushioning – other • describe methods of directional control on land, sea and air vehicles/crafts • describe the method of steering used by most wheeled vehicles • explain the purpose of the parts of a conventional steering system; e.g., steering gear, tie rod end, idler arm, pitman arm and steering knuckle • list the parts of a steering system that are subject to wearing or bending.	

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • identify and describe the action of the following types of braking systems and possible application: – mechanical – hydraulic – electric – air – other • explain the difference between the braking action of a disc and drum brake • determine how tires and tracks vary according to: – road or terrain use – seasonal use – methods of construction • show how to examine the wear pattern on a tire to determine whether it has been: – over or under inflated – improperly aligned – subject to suspension faults – balanced improperly.	Examine the construction of highway and off-highway tires.
Identify/Service	• check and complete a tire repair • complete a tire balance • identify tire wear problems • inspect and repack wheel bearing • list and identify the parts of a braking system that are subject to wearing, seizing or leaking.	

MODULE MEC1160: STRUCTURES & MATERIALS

Level: Introductory

Theme: Suspension and Structural Systems

Prerequisite: None

Module Description: Students identify the types of materials and components used in vehicle construction.

Module Parameters: Access to vehicle, hand tools, fasteners, materials and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools, and follow established lab procedures	• observed performance related to: – following lab/shop established routines – recognition of health hazards and safety procedures associated with coated surfaces – safe handling and disposal of materials. *Assessment Tool* *Task Assessment Checklist: Vehicle Structures and Materials, Part 1, MEC1160–1* *Standard* *Performance rating of 2 on each criteria*	10
• explain the relationship between the function of a vehicle and the materials used in its construction	• report indicating how the function of a vehicle dictates the type of structure and materials used in interior and exterior components. *Assessment Tool* *Task Assessment Checklist: Vehicle Structures and Materials, Part 2, MEC1160–1* *Standard* *Performance rating of 1 or more on each criteria*	30
• examine and identify the basic parts and materials used in vehicle construction	• observed performance in identification of vehicle structures, parts and materials. *Assessment Tool* *Task Assessment Checklist: Vehicle Structures and Materials, Part 3, MEC1160–1* *Standard* *Performance rating of 1 on each criteria*	60

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: - **demonstrate basic competencies.**	*Assessment of student achievement should be based on:* - observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* - state health and environmental issues related to the replacement and repair of coated surfaces - state how hazardous materials are handled and disposed of.	
Consumer Awareness	- outline the historical development of materials used in transportation vehicles - identify what parts of a vehicle are recyclable - cite examples of initiatives that will increase the percentage of parts that can be recycled - list ways government regulations have altered the design and construction of vehicles.	*Highway Traffic Act.*
Identification/ Function	- identify and discuss the factors that have contributed to the use and development of new structural materials - identify the factors used to select a material for a given function - indicate how design and construction of a vehicle is affected by the medium (land, sea, air, space) that it operates in - identify the monoliths and composite materials used in a modern vehicle	This module could be a vehicle-dismantling project—group work possibilities.

MODULE MEC1160: STRUCTURES & MATERIALS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • describe the most appropriate methods of identifying the type of materials used in a part or structure • describe the action of a coil spring when subject to rapid loading • identify design features that are tied more closely to consumer taste than function • describe how to: – reduce the weight of a vehicle – reduce drag – increase passenger safety – increase longevity of structural parts – improve passenger comfort and space • demonstrate knowledge of common types of fasteners used, such as: – studs, bolts, screws – nuts – rivets – clips – clamps • identify what structural coatings are used to: – protect against corrosion – add to the appearance – reduce effects of the sun's radiation – reduce noise.	
Careers	• describe growth occupations that are associated with transportation vehicles • research further education and career opportunities.	Designing, building, recycling.

MODULE MEC1170: METAL FORMING & FINISHING

Level:	Introductory
Theme:	Suspension and Structural System
Prerequisite:	MEC1160 Structures & Materials
Module Description:	Students repair and re-form damaged metal panels.
Module Parameters:	Access to oxy-fuel welding equipment, basic autobody hand/power tools, basic metal refinishing material and resources.
Supporting Module:	FAB1040 Oxyacetylene Welding

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate safe work practices when metal forming and finishing, and follow established lab procedures**	• observed performance related to: – following established lab/shop procedures – safe use of tools/equipment related to metal forming and finishing – recognizing and following personal protective procedures. *Assessment Tool* *Task Assessment Checklist: Metal Forming & Finishing, Part 1, MEC1170–1* *Standard* *Performance rating of 2 on each criteria*	10
• **describe effects of physical damage caused by distortion and corrosion on sheet metal components**	• report indicating effects of physical damage and corrosion on ferrous sheet metal including: – stretching – work hardening of sheet metal – weakening of components through corrosion. *Assessment Tool* *Task Assessment Checklist: Metal Forming & Finishing, Part 2, MEC1170–1* *Standard* *Performance rating of 1 or more on each criteria*	20

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MODULE MEC1170: METAL FORMING & FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• apply metal forming and finishing skills to repair minor panel damage	• observed performance in correcting: – minor dent and/or forming a crown in a panel – small rust out in a panel using welding procedures. *Assessment Tool* *Task Assessment Checklist: Metal Forming & Finishing, Part 3, MEC1170–1* *Illustrative Example: Metal Forming & Finishing, MEC1170–2* *Standard* *Performance rating of 1 or more on each criteria*	70
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate safe practices in relation to: – personal protective equipment/clothes – use of impact tools, drills, grinders, cutters, sheet metal brake and shear – safe use of oxyacetylene and GMAW welding equipment – hazards of body fillers.	
Identify/Analyze	• identify properties of: – low carbon steels – high strength steels	Types of steel; work hardening; affects of impact forces.
	• list tools and equipment available to shape and finish sheet metal	
	• identify the process required for specific types of metal shaping.	Stretching, shrinking.

MODULE MEC1170: METAL FORMING & FINISHING (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • identify processes for metal working and repairing small dents using: – pry bar – pulling tools – hammering techniques • describe possible methods of small rust out repair • describe the best method of small rust out repair • identify various plastic filler materials available • describe the suitable type of plastic fillers to be used • complete a small rust out repair.	Have student distort and reshape a mild steel panel. Demonstrate paintless dent-repair procedures. Use fibreglass, welded patches.
Inspect/Repair	• demonstrate how to: – hammer and dolly metal panel to smooth contour – pick, file and grind panel to desired finish – prepare the surface for filler application – apply plastic fillers and refinish.	Demonstrate use of fibreglass, aluminum, light/premium, polyester fillers.
Careers	• research further education, working conditions and career opportunities.	

MODULE MEC1190: SURFACE PREPARATION 1

Level: Introductory

Theme: Suspension and Structural Systems

Prerequisite: None

Module Description: Students assess the state of a painted surface, and use appropriate restoration procedures.

Module Parameters: Access to painting facilities, surface preparation tools/materials and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices for surface preparation, and follow established lab procedures	• observed performance related to: – following established lab/shop routines with respect to abrasive dust and chemical fumes – safe use of tools/equipment and use of hazardous materials – identification and use of WHMIS bulletins. *Assessment Tool* *Task Assessment Checklist: Surface Preparation, Part 1, MEC1190–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify products, equipment and procedures associated with surface preparation	• a report that includes the following: – list of damage and appropriate repair procedures – list of tools/equipment required – list of appropriate abrasive and other surface preparation materials. *Assessment Tool* *Task Assessment Checklist: Surface Preparation, Part 2, MEC1190–1* *Standard* *Performance rating of 1 or more on each criteria*	30

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
- prepare and perform a surface preparation	- proper analysis and preparation of a surface. *Assessment Tool* *Task Assessment Checklist: Surface Preparation, Part 3, MEC1190–1* *Standard* *Performance rating of 1 or more on each criteria*	60
- demonstrate basic competencies.	- observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* - demonstrate safe practices in relation to: – abrasive dust – chemicals/fumes.	Demonstrate grinding, sandblasting and paint-stripping procedures. Be aware of potential health hazards.
Identify/Analyze	- identify and describe problem conditions in painted surfaces - list types of equipment/tools used in surface preparation processes - list types of abrasives used in surface preparation - identify alternative method of surface preparation; e.g., chemical stripping, blasting - demonstrate knowledge of types, purpose and methods of applying undercoats - identify types and uses of putties - identify methods of masking - list equipment used in masking.	Paint oxidized, peeled, chips, rust, cracking. Masking tape, foam tape, liquid masking and paper types.

MODULE MEC1190: SURFACE PREPARATION 1 (continued)

Concept	Specific Learner Expectations	Notes
Identify/Repair	*The student should:* • explain and demonstrate methods of sanding • use appropriate methods of surface preparation • identify and apply appropriate metal conditioner • demonstrate how to mask a surface prior to painting.	
Careers	• research further education, working conditions and career opportunities.	

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION E: INTERMEDIATE LEVEL

The following pages define the curriculum and assessment standards for the intermediate level of Mechanics.

Intermediate level modules help students build on the competencies developed at the introductory level and focus on developing more complex competencies. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

Module MEC2010: Vehicle Detailing E.3
Module MEC2020: Vehicle Maintenance E.7
Module MEC2030: Lubrication & Cooling E.11
Module MEC2040: Fuel & Exhaust Systems E.15
Module MEC2050: Alternate Fuel Engines E.19
Module MEC2060: Ignition Systems E.21
Module MEC2070: Emission Controls E.25
Module MEC2090: Electrical Components E.29
Module MEC2100: Power Assist Accessories E.33
Module MEC2110: Braking Systems E.37
Module MEC2120: Hydraulic Accessories E.41
Module MEC2130: Drive Trains E.45
Module MEC2140: Transmissions/Transaxles E.51
Module MEC2150: Suspension Systems E.55
Module MEC2160: Steering Systems E.59
Module MEC2170: Metal Repair & Finishing E.63
Module MEC2180: Trim Replacement E.67
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MODULE MEC2010: **VEHICLE DETAILING**

Level: Intermediate

Theme: Vehicle Design and Ownership

Prerequisite: None

Module Description: Students develop the skills required to restore and enhance the exterior finishes of a vehicle.

Module Parameters: Access to commercially available products and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• state personal and environmental hazards associated with the use of cleaning and waxing agents	• presentation of a report describing: – hazards associated with use of cleaning and waxing products – environmental concerns in the use of cleaning agents – products that are less hazardous. *Assessment Tool* *Task Assessment Checklist: Vehicle Detailing, Part 1, MEC2010–1* *Standard* *Performance rating of 2 on each criteria*	15
• identify and describe materials available to enhance the appearance of a vehicle	• identification of materials and products used in detailing a vehicle such as: – surface-enhancing material – trim additions. *Assessment Tool* *Task Assessment Checklist: Vehicle Detailing, Part 2, MEC2010–1* *Standard* *Performance rating of 2 on each criteria*	15
• demonstrate correct cleaning and treatment of engine parts and exterior finishes including paint, glass, vinyl and rubber surfaces	• observed performance related to cleaning and enhancing painted, glazed, vinyl and rubber surfaces including engine compartment and exterior components. *Assessment Tool* *Task Assessment Checklist: Vehicle Detailing, Part 3, MEC2010–1* *Standard* *Performance rating of 2 on each criteria*	20

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MODULE MEC2010: VEHICLE DETAILING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **install a trim or accessory part according to standard practice**	• observed performance associated with trim installation including: – use of instructional resources – use of tools and materials – identification of parts. *Standard* *Performance rating of 2 on each criteria* *Assessment Tool* *Task Assessment Checklist: Vehicle Detailing, Part 4, MEC2010–1*	50
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tools* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow safety rules and procedures in the handling of dangerous cleaning agents • demonstrate safe handling and application of volatile cleaners used for engine cleaning • demonstrate knowledge of and follow procedures outlined to prevent damage to electrical or other parts when engine cleaning • identify hazards that are present, including acid powder.	Be aware of WHMIS regulations. Use environmentally friendly products.
Identify/Analyze	• identify and demonstrate the correct procedures when using cleaning and polishing/treatment agents on various surfaces • identify surface flaws and solutions that could be used other than spray painting • explain the value of using waxes to treat painted surfaces (including longevity and monetary implications)	Relate to paintless dent repair.

MODULE MEC2010: VEHICLE DETAILING (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • identify common types of trim fasteners and tools • list the precautions needed to prevent damage to trim or adjacent surfaces when removing and replacing trim parts • explain the value and methods used to enhance the appearance of a vehicle without painting.	Recommend that silicone-free products be used.
Inspect/Repair	• show knowledge of and demonstrate the procedures and tools used to remove and replace trim parts • demonstrate the application of decals, pin striping and/or molding as a method of enhancing vehicle appearance and value • demonstrate the ability to follow installation instructions by completing an accessory installation project • use materials available to complete an engine clean and, if possible, apply enhancing materials such as paints or coatings • describe the value of maintaining a clean and neat engine compartment.	Discuss the use of decals, pin striping and moldings to improve the value of a vehicle.
Careers	• identify further education, working conditions and career opportunities related to vehicle detailing.	

MODULE MEC2020: VEHICLE MAINTENANCE

Level: Intermediate

Theme: Vehicle Design and Ownership

Prerequisite: MEC1020 Vehicle Service & Care

Module Description: Students perform the basic service requirements necessary to ensure adequate maintenance of a motor vehicle.

Module Parameters: Access to vehicles, specialty tools, hand tools and related resources.
Note: Customer work to be checked by certified technician when work performed on brakes, steering and suspension.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with vehicles, and follow established lab procedures	• observed performance in: – following established lab/shop routines – use of WHMIS information as it applies to oil, grease, gasoline and antifreeze – working with others – safe use of materials/tools/equipment. *Assessment Tool* *Task Assessment Checklist: Vehicle Maintenance, Part 1, MEC2020–1* *Standard* *Performance rating of 2 on each criteria*	15
• identify vehicle service requirements as per manufacturer's recommendations	• creation of a service schedule for a given vehicle indicating: – make, model, year and serial number – system or unit to be checked, serviced or replaced – time, distance travelled and service condition. *Assessment Tool* *Task Assessment Checklist: Vehicle Maintenance, Part 2, MEC2020–1* *Standard* *Performance rating of 2 on each criteria*	15

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MODULE MEC2020: VEHICLE MAINTENANCE (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **conduct a motor vehicle inspection considering age of vehicle, distance travelled, service conditions and history**	• observed performance related to the inspection of: – lights and accessories – engine cooling, fuel, exhaust, ignition emission, lubrication and mechanical systems – drive train, running gear and body – overall condition of body parts. *Assessment Tool* *Task Assessment Checklist: Vehicle Maintenance, Part 3, MEC2020–1* *Standard* *Performance rating of 2 on each criteria*	25
• **service and repair a motor vehicle according to vehicle condition and service schedule**	• observed performance in servicing a given vehicle according to the prepared schedule. *Assessment Tool* *Task Assessment Checklist: Vehicle Maintenance, Part 4, MEC2020–1* *Standard* *Performance rating of 2 on each criteria*	45
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures.	Be aware of WHMIS and school district's guidelines.
Identify/Analyze	• identify the service requirements for a specific motor vehicle considering the odometer reading, conditions of operation and service history	

MODULE MEC2020: VEHICLE MAINTENANCE (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • identify and describe condition of the camshaft timing belt or chain and recommend the appropriate service • evaluate brake system fluid integrity and brake pedal feel and identify repair requirements.	Compare with manufacturer's specifications.
Inspect/Service	• demonstrate how to: – inspect an engine for oil leaks – renew engine gaskets or seals, where necessary – change engine oil and filter – service PCV valve and breather – inspect the condition of coolant, hoses, belts, fan and radiator; adjust belts if required – change or recondition the engine coolant and flush the cooling system, if required – pressure test the cooling system – replace the thermostat, if necessary – locate and inspect the fuel filter; replace if required – replace the air filter, if required – inspect and service throttle linkage – inspect manifolds, pipes, catalytic converter, muffler and hangers for structural integrity; repair as required – inspect and service or replace spark plugs, distributor cap and rotor and spark plug wires and boots as required by the service schedule – inspect and replace fuel purge canister filter, if required – inspect and replace fluids as required in transmissions, transaxle transfer cases and differential assemblies – inspect and recommend service for constant velocity joints, seals, drive shaft, drive axles and U-joints	Demonstrate proper jacking/hoisting systems.

Concept	Specific Learner Expectations	Notes
Inspect/Service (continued)	*The student should:*	
	– check tire condition	
	– mount and balance tires	
	– rotate tires to maximize wear life	
	– inspect steering and suspension system components	
	– inspect, repack and adjust wheel bearing	
	– lubricate steering and suspension system joints	
	– replenish fluids in power steering pump	
	– inspect and top up brake fluid reservoir	Be aware of the effects of brake fluid on painted surfaces.
	– inspect and assess the wear characteristics of disc brake and drum brake components	
	– lubricate parking brake linkages	
	– inspect and service battery and battery clamps, renew clamps if required	Be aware of hazards when working with lead-acid storage batteries.
	– adjust alternator belt tension if necessary	
	– check the operation of all lights and replace required bulbs	
	– inspect fuse panel and renew inoperative fuses	
	– use a multimeter to test a charging system	Students need to be reminded to keep clear of all moving parts when checking a system.
	– lubricate hinges on all opening panels and weather strips	Access vehicle inspection forms from auto dealers and auto body repair shops.
	– lubricate locks or lock plates, as required	
	– inspect and change windshield wiper blades, if necessary	
	– inspect for loose trim or moldings.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2030: **LUBRICATION & COOLING**

Level: Intermediate

Theme: Propulsion Systems

Prerequisite: MEC1040 Engine Fundamentals

Module Description: Students diagnose, maintain and service the lubrication and cooling systems of a typical four-cycle gasoline engine.

Module Parameters: Access to pressure tester, hand tools and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with vehicle engine fluids	• observed performance related to: – appropriate selection of personal and vehicle protective equipment when working with engine fluids – maintaining an organized and tidy workplace – using correct tools and materials in a safe and efficient manner – using appropriate fluids for oil changes/cooling systems – ensuring used fluids are placed in appropriate marked containers and stored correctly. *Assessment Tool* *Task Assessment Checklist: Lubrication & Cooling, Part 1, MEC2030–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify and describe functions and operations of engine cooling and lubrication system components	• observed performance related to: – engine cooling and lubrication system components identification – description of properties of coolants and lubricating oils – selection and use of resources including service manuals. *Assessment Tool* *Task Assessment Checklist: Lubrication & Cooling, Part 2, MEC2030–1* *Standard* *Performance rating of 2 on each criteria*	35

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MODULE MEC2030: LUBRICATION & COOLING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **diagnose and correct lubrication and cooling system faults**	• diagnoses and repair of a lubrication and cooling system. *Assessment Tool* *Task Assessment Checklist: Lubrication & Cooling, Part 3, MEC2030–1* *Standard* *Performance rating of 2 on each criteria*	55
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• identify the hazards associated with ethylene glycol • demonstrate knowledge of and follow all safety procedures associated with hot fluids and fluids under pressure • collect and dispose of all hazardous fluids in the appropriate manner • remove all spills from work area.	All products must be labelled and stored correctly. To environmental standards.
Identification/ Function	• identify the multiple tasks performed by the lubrication system • describe the properties of engine oils intended for use in a late model engine • interpret the meaning of the American Petroleum Institute (API) and Society of Automotive Engineers (SAE) symbol and viscosity numbers used on oil containers	

MODULE MEC2030: LUBRICATION & COOLING (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Functions (continued)	*The student should:* • describe the design and operation of a: – gear and rotor-type oil pump – pressure regulator or relief valve – oil pressure sensor gauge or indicator – oil level and change indicator • identify possible cause of low/high oil pressure and high levels of oil consumption under normal operating conditions • explain the function of the cooling system • describe the relationship between the percentage of antifreeze and water to the coolant's freezing and boiling points • identify the most appropriate percentage of antifreeze to meet local conditions • describe the design and operation of a: – radiator and cap – thermostat – water pump – radiator – fan – hoses – recovery tank – block heater • identify possible causes for engine overheating or running cold under normal operating conditions.	Provide sample pumps for students to examine. Examine a direct clutch and electric fan assembly. If activities are not done on live units, have students perform them on shop units.
Inspect/Service	• demonstrate how to: – inspect engine for oil leaks owing to gasket/seal failure – replace seal/gaskets if necessary – disassemble and inspect a gear or rotor pump for pitting and galling or abnormal wear – test oil pressure sensor; gauge/light circuit service if necessary – test temperature sensing system; service if necessary – inspect hoses for cracks, soft spots and leaks; replace if necessary – test thermostat; replace if necessary	Students, at some point, should have the opportunity to remove and replace an oil and water pump, radiator, thermostat, fan and fan belt.

Concept	Specific Learner Expectations	Notes
Inspect/Service (continued)	*The student should:* – inspect water pump for leaks and bearing condition – inspect radiator fan – inspect radiator for leaks, blockages; replace if necessary – check condition and tension of fan belt; replace if necessary.	
Careers	• identify further education and work opportunities related to aftermarket parts supply and rebuilding.	

MODULE MEC2040: **FUEL & EXHAUST SYSTEMS**

Level: Intermediate

Theme: Propulsion Systems

Prerequisite: MEC1040 Engine Fundamentals

Module Description: Students diagnose, maintain and service the fuel and exhaust system of a typical four-cycle gasoline engine.

Module Parameters: Access to ventilated area, fuel pump vacuum/pressure tester and related resources and to instruction from a certified technician when working on a customer vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with volatile liquids and combustion gases	• observed performance related to: – following shop routines and procedures – following safe practices and proper use of storage containers, safety devices, tools and equipment while working on fuel and exhaust systems – proper use of fire extinguishers, storage containers, measuring devices, meters and related tools and equipment. *Assessment Tool* *Task Assessment Checklist: Fuel & Exhaust Systems, Part 1, MEC2040–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify and describe functions and operations of engine fuel and exhaust system components	• identification and description of fuel and exhaust system components, functions and operations • description of the importance and effects of correct air fuel ratio on combustion • description of the symptoms associated with a rich mixture–lean mixture • discussion of air flow, atomizing, pre- and post-ignition • explanation of factors that affect exhaust system performance. *Assessment Tool* *Task Assessment Checklist: Fuel & Exhaust Systems, Part 2, MEC2040–1* *Standard* *Performance rating of 2 on each criteria*	25

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• diagnose and correct fuel and exhaust system faults	• observed performance related to: – use of service manuals and related resources – diagnosing fuel and exhaust system faults – servicing/repairing fuel and exhaust systems. *Assessment Tool* *Task Assessment Checklist: Fuel & Exhaust Systems, Part 3, MEC2040–1* *Standard* *Performance rating of at least 2 on each criteria*	65
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow all safety procedures associated with volatile liquids and exhaust gases • demonstrate how to: – store fuels and solvents in the appropriate manner – maintain proper venting and air supply in the work area.	Be aware of the dangers of gasoline spills and carbon monoxide gases in the work environment.

MODULE MEC2040: FUEL & EXHAUST SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function	*The student should:* • describe the chemical composition of gasoline and the effect complete and incomplete combustion have on the environment and engine performance • describe the characteristics of a quality gasoline in relation to its volatility and octane rating • identify measures that are taken to: – prevent the formation of gum deposits – prevent the oxidation of metal parts – retard icing – aid in the identification of fuel types and grades • describe the factors that affect combustion, such as: – spark plug location – combustion chamber size and shape – compression ratio – valve and combustion chamber design – spark timing, duration and intensity – air temperature and fuel ratio – manifold pressures – valve timing, valve lift and duration • identify and describe the function of the major fuel system components • explain the difference between a carburetor and a fuel injected system • identify the common problems associated with carburetors and fuel injected systems • locate and describe the function of the major exhaust system components.	Note the effect of a blocked exhaust system.

Concept	Specific Learner Expectations	Notes
Inspect/Service	*The student should:* • inspect fuel filter/strainer and replace if necessary • clean and adjust a typical carburetor on and off an engine • visually inspect and test a typical fuel injection system • test fuel pump pressure and capacity; repair or replace if necessary • visually inspect and test for exhaust leaks or blockages; replace converters, pipes, mufflers if necessary.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2050: ALTERNATE FUEL ENGINES

Level: Intermediate

Theme: Propulsion Systems

Prerequisite: MEC1040 Engine Fundamentals

Module Description: Students determine alternate fuels used to power motor vehicles.

Module Parameters: Access to related resources, basic hand tools.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with alternate fuel vehicles	• observed performance related to: – appropriate personal and vehicle safety procedures when starting, stopping, parking and refuelling alternate fuel vehicles – safe storage of alternate fuels. *Assessment Tool* *Task Assessment Checklist: Alternate Fuel Engines, Part 1, MEC2050–1* *Standard* *Performance rating of 2 on each criteria*	20
• determine the type of fuel that is best suited to a particular use and type of vehicle	• ability to identify alternate fuels that are best suited to particular tasks and requirements. *Assessment Tool* *Task Assessment Checklist: Alternate Fuel Engines, Part 2, MEC2050–1* *Standard* *Performance rating of 2 on each criteria*	35
• service an alternate fuelled vehicle, recognizing its unique maintenance requirements	• performance in servicing an alternate fuelled vehicle. *Assessment Tool* *Task Assessment Checklist: Alternate Fuel Engines, Part 3, MEC2050–1* *Standard* *Performance rating of 2 on each criteria*	45
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures • state how alternative fuels affect the environment	Note dangers involved in working on vehicles using, e.g., propane, natural gas.
Identification/ Function	• identify the typical alternate fuels; e.g.: – diesel – propane – methanol – natural gas – hydrogen • compare the heat-producing characteristics of each fuel • identify resources and methods of marketing different types of fuel • identify ways in which fuels are stored • describe the engine design modifications that are required to operate on: – diesel – propane – methanol – others.	Use BTU charts from oil companies. Bulk and vehicle storage.
Application	• describe the advantages of using an alternate fuel by considering: – fuel cost – availability – performance – engine life – environmental impact.	
Inspect/Service	• describe the specific service requirement for an alternate fuel engine • complete a service and maintenance task according to the manufacturer's recommendations; e.g., change oil and fuel filters, engine lubricant, glow plugs and heaters.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2060: IGNITION SYSTEMS

Level:	Intermediate
Theme:	Propulsion Systems
Prerequisite:	MEC1040 Electrical Fundamentals
Module Description:	Students identify the basic components and parts of ignition systems used on internal combustion engines, and service and repair an ignition system.
Module Parameters:	Access to multimeter, timing light, hand tools and related resources.
Supporting Module:	MEC1090 Electrical Fundamentals

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• follow electrical safety guidelines by accurately interpreting and using instruction manuals	• observed performance related to: – selection and use of resources and materials – recognition of dangers of high voltages and currents. *Assessment Tool* *Task Assessment Checklist: Ignition Systems, Part 1, MEC2060–1* *Standard* *Performance rating of at least 2 on each criteria*	10
• explain how a timed high voltage spark is achieved in magneto, point and electronic ignition systems	• ability to explain how the parts of magneto, point and electronic ignition systems function to produce timed ignition spark. *Assessment Tool* *Task Assessment Checklist: Ignition Systems, Part 2, MEC2060–1* *Standard* *Performance rating of 2 on each criteria*	20
• recognize the drivability symptoms, and use visual and instrument checks to diagnose ignition system faults	• observed performance related to the ability to: – visually diagnose ignition faults – use instruments to diagnose faults – analyze drivability symptoms. *Assessment Tool* *Task Assessment Checklist: Ignition Systems, Part 3, MEC2060–1* *Standard* *Performance rating of 2 on each criteria*	30

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MODULE MEC2060: IGNITION SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• service and repair an ignition system	• observed performance in: – servicing point ignition system – servicing electronic ignition system – correcting a defective system. *Assessment Tool* *Task Assessment Checklist: Ignition Systems, Part 3, MEC2060–1* *Standard* *Performance rating of 3 on each criteria*	40
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures • describe hazards involved when working with high voltages and currents.	Be aware of the potential for shocks and burns.
Identification/ Function	• list and describe the three common types of ignition systems • name the parts of a: – magneto – point type – electronic ignition system – computer-coil (distributorless ignition)	Describe a distributorless ignition system.

MODULE MEC2060: IGNITION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • identify and describe symptoms produced by a typical ignition failure; e.g.: – loose connection(s) – faulty spark plug(s) – faulty coil or wire – bad distributor cap or rotor – faulty points – faulty pick-up coil.	
Inspect/Service	• test the following: – primary circuit voltage drop – high tension lead resistance – ignition coil – ignition cap – pick-up coil – distributor points and condensor – advance mechanisms • show how to remove and analyze a spark plug to determine how well the engine is operating; e.g., oil consumption, fuel/air ratio and determine service/ repair required • lubricate distributor • clean and tighten electrical leads and connections • complete the following according to the manufacturer's specifications: – clean gap and/or replace with new spark plugs – clean and/or replace with new contact points – adjust contact points and pick up coil gap – adjust/repair advance mechanisms – set ignition timing statically and check with a timing light.	Use and electronic ignition tester for electronic systems.
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2070: **EMISSION CONTROLS**

Level: Intermediate

Theme: Propulsion Systems

Prerequisite: MEC1040 Engine Fundamentals

Module Description: Students describe the importance of controlling emissions and the technology applied to vehicles to meet prescribed standards.

Module Parameters: Access to specialized equipment and resources related to analyzing and testing emission control.

Supporting Modules:
MEC2030 Lubrication & Cooling
MEC2040 Fuel & Exhaust Systems
MEC2060 Ignition Systems

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with emission control systems	• observed performance related to: – safety procedures in use of tools and equipment related to vehicle emissions – appropriate selection of and use of protective equipment – recognition and control of hazards associated with engine emissions. *Assessment Tool* *Task Assessment Checklist: Emission Controls, Part 1, MEC2070–1* *Standard* *Performance rating of 2 on each criteria*	10
• list and describe vehicle pollutants and their effects on the environment	• observed performance related to: – listing vehicle emissions – explaining exhaust emissions and their effects on the environment – stating regulations pertaining to exhaust emission levels – comparing emissions produced by gasoline as compared to alternate fuels. *Assessment Tool* *Task Assessment Checklist: Emission Controls, Part 2, MEC2070–1* *Standard* *Performance rating of 2 on each criteria*	15

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MODULE MEC2070: EMISSION CONTROLS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe types and characteristics of pre- and post-combustion emission systems	• ability to identify and describe: – types of pre- and post-combustion emission control systems – parts of pre- and post-combustion emission systems – the function and operation of pre- and post-combustion emission systems. *Assessment Tool* *Task Assessment Checklist: Emission Controls, Part 3, MEC2070–1* *Standard* *Performance rating of 2 on each criteria*	15
• identify emission control components	• observed performance associated with: – locating and identifying components on a vehicle – describing how components work together to reduce emissions – evaluating a given system for efficiency. *Assessment Tool* *Task Assessment Checklist: Emission Controls, Part 4, MEC2070–1* *Standard* *Performance rating of 2 on each criteria*	25
• diagnose and service emission control systems	• observed performance related to: – connection of a gas analyzer to a vehicle – reading and recording the exhaust emissions – analyses of emission system functions – servicing emission control systems. *Assessment Tool* *Task Assessment Checklist: Emission Controls, Part 5, MEC2070–1* *Standard* *Performance rating of 2 on each criteria*	35
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC2070: EMISSION CONTROLS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures. • describe effect of vehicle emissions on the environment and specifically on human life.	Discuss the effects of smog and carbon monoxide.
Identification/ Function	• list types and where vehicle pollutants are created • explain how these pollutants are created • identify regulations that dictate maximum pollutant levels • identify and demonstrate knowledge of the operation of the following pre-combustion control systems: – crankcase ventilation system – exhaust gas recirculation system – ignition spark control systems – computerized engine controls – evaporative control systems – engine design modifications; i.e., combustion chamber, piston, cylinder head, manifold and air induction design • identify and demonstrate knowledge of the operation of the following post-combustion control systems on several different types of vehicles: – air injection system – air aspirator system – catalytic converters	

MODULE MEC2070: EMISSION CONTROLS (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Service	*The student should:* • demonstrate how to: – check and service positive crankcase ventilation system – check and service evaporative control system – check and service air injector system – check and service exhaust gas recirculation system – check catalytic converter – check and adjust spark control system – check computerized engine controls – using exhaust gas analyzer (if available), check emissions for a given vehicle.	As per manufacturer's specifications. All customer work should be checked by a certified technician. Check readings for hydrocarbons, carbon monoxide, oxygen and carbon dioxide levels.

MODULE MEC2090: ELECTRICAL COMPONENTS

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC1090 Electrical Fundamentals

Module Description: Students identify and describe the basic use and testing of the electrical components of a typical motor vehicle.

Module Parameters: Voltmeter, ohmmeter, ammeter, alternator, starter and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with electrical components	• observed performance in relation to: – following shop electrical routines – avoiding electrical shorts, sparks and unwanted grounds – observing proper polarity. *Assessment Tool* *Task Assessment Checklist: Electrical Components, Part 1, MEC2090–1* *Standard* *Performance rating of 2 on each criteria*	10
• describe the function and operation of a vehicle's electrical systems and components	• a report that lists and describes the – purpose and function of vehicle electrical systems – principal components in each system – overall operation of the electrical system. *Assessment Tool* *Task Assessment Checklist: Electrical Components, Part 2, MEC2090–1* *Standard* *Performance rating of 2 on each criteria*	15

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MODULE MEC2090: ELECTRICAL COMPONENTS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify electrical faults, by using standard diagnostic and testing procedures	• observed performance in: – use of voltmeter, ohmmeter and ammeter – testing for open and closed circuits – testing for load voltage and voltage drop – testing for current draw – testing for resistances – recognizing abnormal electrical circuit conditions. *Assessment Tool* *Task Assessment Checklist: Electrical Components, Part 3, MEC2090–1* *Standard* *Performance rating of 2 on each criteria*	25
• test and service electrical components	• observed performance in testing and overhaul of: – starter motor repair and assembly – alternator repair and assembly – testing assembled starter/alternator. *Assessment Tool* *Task Assessment Checklist: Electrical Components, Part 4, MEC2090–1* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures with respect to electrical hazards, such as: – electrical shocks – electrical burns • demonstrate how to avoid sparks and grounding • explain electrical polarity.	Be aware of the dangers of wearing jewellery.

MODULE MEC2090: ELECTRICAL COMPONENTS (continued)

Concept	Specific Learner Expectations	Notes
System/Component Function	*The student should:* • locate the major electrical/electronic systems in a motor vehicle: lighting, charging and starting • explain the operation and function of each of the electrical/electronic systems • show how electrical/electronic systems interact with other vehicle systems; e.g., suspension and braking systems • for charging, starting and lighting systems, identify and explain the purpose and their basic component parts • identify and draw the symbols for common electrical components • identify and describe the ratings that are given to electrical components; e.g., resistance, voltage, amperage and power rating.	Draw block diagrams.
Identification/ Function	• identify and describe the purpose and functions of a: – voltmeter – ohmmeter – ammeter – multimeter – load tester – tack dwell meter – growler • calibrate correctly, connect accurately and read the appropriate test equipment to determine: – open and closed circuit – load voltage and drop – current draw – component resistance.	Perform insulated and ground circuit resistance tests.
Inspect/Repair	• identify and correct faults associated with electrical components and instruments • overhaul a starter motor assembly • overhaul an alternator.	

MODULE MEC2100: POWER ASSIST ACCESSORIES

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC1110 Pneumatics & Hydraulics

Module Description: Students identify and explain the function of components and parts of power assist accessories.

Module Parameters: Multimeter, power accessories and related resources.
Note: Customer work must be checked by certified technician.

Supporting Module: MEC1090 Electrical Fundamentals

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working on power accessories	• observed performance related to: – personal safety and vehicle care when working with power accessories – maintenance of a clean and organized workplace – safe and efficient use of tools and equipment. *Assessment Tool* *Task Assessment Checklist: Power Assist Accessories, Part 1, MEC2100–1* *Standard* *Performance rating of 2 on each criteria*	15
• list components and state functions of power assist accessories	• observed performance related to: – preparation of a comprehensive list of available power assist accessories – identification of components in power assist systems – demonstration of power accessories that can be used to assist mechanical systems. *Assessment Tool* *Task Assessment Checklist: Power Assist Accessories, Part 2, MEC2100–1* *Standard* *Performance rating of 2 on each criteria*	20

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MODULE MEC2100: POWER ASSIST ACCESSORIES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• describe and check major components of power accessories	• description and assessment of major components including mechanical and electrical devices. *Assessment Tool* *Task Assessment Checklist: Power Assist Accessories, Part 3, MEC2100–1* *Standard* *Performance rating of 2 on each criteria*	25
• service and repair power accessories	• observed performance related to: – following procedures to isolate and identify faulty components/system – servicing and repairing faulty power assist accessories – test to establish that the fault has been remedied – analysis of possible factors that caused the failure in the component. *Assessment Tool* *Task Assessment Checklist: Power Assist Accessories, Part 4, MEC2100–1* *Standard* *Performance rating of 2 on each criteria*	40
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC2100: POWER ASSIST ACCESSORIES (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate established lab safety procedure • demonstrate practices that prevent damage to components.	
Identification/ Function	• describe the types and basic functions of power accessories found on vehicles • compare power accessories to the mechanical system they have replaced • evaluate current power accessories as a means of forecasting types of power accessories that may be used in future vehicles.	Describe steering, brakes, suspension, windows, door locks, antennae applications.
System/Component Function	• list the parts of selected power accessories • describe the function of the major parts of selected power accessories • trace the power path of selected power accessories.	
Inspect/Repair	• demonstrate how to use shop manuals to diagnose power accessory faults specific to power accessories • identify problems and faults in power accessories systems.	All services, diagnoses, repairs and replacements of parts must be checked by a licenced technician.

MODULE MEC2110: BRAKING SYSTEMS

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC1110 Pneumatics & Hydraulics

Module Description: Students develop the necessary knowledge, skills and attitudes to diagnose, service and maintain a braking system according to accepted trade practices.

Module Parameters: Access to specialized brake tools and related resources.
Note: Customer work must be supervised by certified technician.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working on brakes	• observed performance related to: – appropriate selection and use of protective supplies and equipment for personal safety – following established safety procedures while working on vehicle brakes – safe practices when cleaning and repairing asbestos parts. *Assessment Tool* *Task Assessment Checklist: Braking Systems, Part 1, MEC2110–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify brake design and components, and emergency brake systems	• performance measured by: – identification and description of brake components – identification of primary braking and emergency systems. *Assessment Tool* *Task Assessment Checklist: Braking Systems, Part 2, MEC2110–1* *Standard* *Performance rating of 2 on each criteria*	15

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MODULE MEC2110: BRAKING SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• inspect and analyze disc and drum brake systems	• observed performance related to: – listing factors/symptoms of worn or defective brake parts – visual recognition of worn or defective brake parts – use of tools/equipment to determine worn or defective brake parts. *Assessment Tool* *Task Assessment Checklist: Braking Systems, Part 3, MEC2110–1* *Illustrative Example: Braking Systems, MEC2110–2* *Standard* *Performance rating of 2 on each criteria*	15
• interpret parts and service manuals to perform routine brake system service and maintenance	• observed performance related to: – replacing brake shoes – replacing disc pads – resurfacing disc rotor and brake drum – removing and installing/repairing master cylinder, wheel cylinder, brake line/hoses – bleeding brake system – adjusting and servicing emergency brake. *Assessment Tool* *Task Assessment Checklist: Braking Systems, Parts 4 and 5, MEC2110–1* *Illustrative Example: MEC2110–2 Braking Systems* *Standard* *Performance rating of 2 on each criteria*	60
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC2110: BRAKING SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures.	Be aware of asbestos hazards and effects of brake fluid on painted surfaces.
Identification/ Function	• identify the parts of a hydraulic brake drum system • compare the operating principles of duo-servo and non-servo brake systems • identify the parts of a disc brake system • compare the operating principles of a fixed, floating and sliding caliper braking system • describe operation of a combined disc and drum system • identify the parts of an emergency brake system • compare the operating principles of an emergency brake system on disc and drum brake applications.	Consider valves involved.
Inspect/Service	• show how to: – prepare a work order, using appropriate questioning to determine brake problem – check a master cylinder fluid level – inspect drum and disc brake linings for wear – inspect drum and rotor for service – adjust an emergency brake cable.	
Inspect/Repair	• demonstrate how to: – machine a brake drum and rotor according to the manufacturer's specifications – remove and replace disc and drum brake shoes – remove/replace and overhaul master cylinder, wheel cylinder and caliper – replace a flexible brake hose – bleed and flush a brake system.	Be familiar with internal components and rebuilding procedures. On road-licenced vehicle must have final inspection done by certified personnel.

Concept	Specific Learner Expectations	Notes
Careers	*The student should:* • identify further education, working conditions and career opportunities.	

MODULE MEC2120: HYDRAULIC ACCESSORIES

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC1110 Pneumatics & Hydraulics

Module Description: Students develop a basic knowledge of hydraulic components, applications and servicing techniques.

Module Parameters: Access to basic hand tools hydraulic systems and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with hydraulic systems	• observed performance related to: – hazards associated with pressurized hydraulic equipment – safe use of tools, equipment and materials – safe use of personal protective equipment – correct use of equipment and supplies used on vehicles. *Assessment Tool* *Task Assessment Checklist: Hydraulic Accessories, Part 1, MEC2120–1* *Standard* *Performance rating of 2 on each criteria*	10
• describe functions of hydraulic components in a hydraulic system	• observed performance related to: – the identification and description of hydraulic components – appropriate use of hydraulic resources. *Assessment Tool* *Task Assessment Checklist: Hydraulic Accessories, Part 2, MEC2120–1* *Standard* *Performance rating of 2 on each criteria*	15
• interpret parts and service manuals to provide appropriate maintenance and service procedures on a hydraulic system	• observed performance related to: – listing appropriate servicing procedures and techniques on hydraulic components – developing a service schedule for a given application – interpreting parts and service manuals. *Assessment Tool* *Task Assessment Checklist: Hydraulic Accessories, Part 3, MEC2120–1* *Standard* *Performance rating of 2 on each criteria*	50

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **service hydraulic components**	• servicing individual components on a given a hydraulic system. *Assessment Tool* *Task Assessment Checklist: Hydraulic Accessories, Part 4, MEC2120–1* *Standard* *Performance rating of 2 on each criteria*	25
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures • explain hazards associated with pressure and heat build-up hydraulic systems.	
Identify/Analyze	• describe the properties of hydraulic fluids in relation to: – viscosity – lubricating ability – resistance to oxidation – corrosion prevention • identify the common types of connecting lines/hoses, fitting and seals • describe the internal parts of a reservoir and state the purpose of filters, strainers and breathers • describe the construction and operation of: – cylinder – gear and vane motors	

MODULE MEC2120: HYDRAULIC ACCESSORIES (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • describe the function of: – check and pressure control valves – two- and four-way valves • describe the construction and operation of gear, vane and piston pumps • explain why and when accumulators are used in a hydraulic system.	
Inspect/Service	• demonstrate how to: – check fluid levels in reservoirs – clean strainers – replace system filters with the approved parts – check seals for leaks and replace – replace a defective hose, line and fitting – replace the hydraulic fluid in a system.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2130: **DRIVE TRAINS**

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC1130 Mechanical Systems

Module Description: Students identify the purpose, describe the operation and perform the servicing of a vehicle drive train.

Module Parameters: Access to drive train units, hand tools, specialized drive train tools and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working with vehicle drive trains	• observed performance related to: – safe practices using equipment, tools and materials – safe procedures when working with vehicle drive train parts and components – following proper lifting and handling procedures. *Assessment Tool* *Task Assessment Checklist: Drive Trains, Part 1, MEC2130–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify purpose and describe function of the major drive train components	• measured performance related to: – identification of major drive train components and their purpose – explanation of the inter-relationship between major components – developing a service schedule for drive train components. *Assessment Tool* *Task Assessment Checklist: Drive Trains, Part 2, MEC2130–1* *Standard* *Performance rating of 2 on each criteria*	20

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MODULE MEC2130: DRIVE TRAINS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• execute inspection, diagnostic, service and repair procedures on specific drive train components	• observed performance related to: – inspection and diagnosis of drive train components (clutch, manual transmission, automatic transmission drive axles/shaft, and differential) – service of drive train components – removal/replacement of drive train components. *Assessment Tool* *Task Assessment Checklist: Drive Trains, Part 3, MEC2130–1* *Standard* *Performance rating of 2 on each criteria*	50
• identify career opportunities related to drive train repairs	• observed performance related to: – reporting up-to-date information concerning opportunities in the drive train area. *Assessment Tool* *Assessment Guide: Career Profile, MECCPR* *Standard* *Performance rating of at least 2 on each criteria*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures • identify potential back problems associated with lifting heavy objects.	
Identification/ Function	• state the overall purpose of the power transmission system in a vehicle • list and describe the function of component assemblies in a drive train	

MODULE MEC2130: DRIVE TRAINS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • differentiate between the following drive trains: – front wheel drive – rear wheel drive – four wheel drive: • front–rear • rear–front – all wheel drive.	
Inspect/Service and Repair	• create a service schedule for each drive train component to include fluid change interval and type • demonstrate how to: – check fluid levels – remove and install drive train components – assess clutch serviceability – check and adjust clutch linkage for correct free play or check operation of automatic adjuster if so equipped – check manual transmission fluid level and replenish or replace as necessary, considering the service requirement characteristics of the vehicle – check manual transmission for leaks and replace the required seal(s) if possible, or recommend the repair requirement – adjust transmission shifting linkages – service an automatic transmission by replacing the fluid, filter and oil pan gasket – check automatic transmission assembly for leakage and replace the required seal(s) if possible, or recommend the repair requirement – inspect drive shaft or drive axle components such as: • joints • straps	

Concept	Specific Learner Expectations	Notes
Inspect/Service and Repair (continued)	*The student should:* – repair the coupling joint or shaft as required to return it to serviceability according to manufacturer's specifications – inspect transfer case fluid level and replenish or replace as required by service schedule – check transfer case linkage operation and adjust or repair as required to ensure serviceability – assess transfer case operation of the assembly and repair, or recommend repair requirement – inspect the transfer case assembly for leaks and replace the required seal(s), or recommend the repair requirement – locate and inspect viscous clutch if the vehicle is so equipped and repair or recommend the required repair – check differential fluid and either replenish or replace as necessary, considering the vehicle's operating conditions and service interval scheduling specifications – remove a differential cover and identify the parts enclosed, or if not an integral type of differential, remove the carrier assembly identifying the parts – inspect differential housing for filings and inspect gears and bearings for wear and repair needs – calculate differential gear ratio between the crown and pinion gears and determine the torque multiplication that results – reassemble differential and check assembly for leaks, replacing the required seals or recommending repair required – inspect the drive train components for alignment, wear and looseness – using a mechanics stethoscope, test the assemblies for noise at bearing locations while the system is being operated	

Concept	Specific Learner Expectations	Notes
Inspect/Service and Repair (continued)	*The student should:* – identify the cause of noise or vibration and repair or recommend required repair – inspect isolation mounts and bushings at the drive train assemblies to assess capability of noise or vibration transference.	
Careers	• identify local businesses specializing in drive train repairs, and determine the working conditions and career opportunities.	

MODULE MEC2140: TRANSMISSIONS/TRANSAXLES

Level: Intermediate

Theme: Guidance and Control Systems

Prerequisite: MEC2130 Drive Trains

Module Description: Students perform inspection service and repair procedures on manual transmissions, transaxles and clutch assemblies.

Module Parameters: Access to pilot shafts, specialized manual transmission tools, presses, pullers related resources and clutch, transmission and transaxle units.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working on transmissions and transaxles	• observed performance related to: – safe use of equipment, tools, materials and supplies – proper use of personal safety equipment – correct use of vehicle protective equipment – proper lifting techniques to avoid back injuries. *Assessment Tool* *Task Assessment Checklist: Transmissions/ Transaxles, Part 1, MEC2140–1* *Standard* *Performance rating of 2 on each criteria*	20
• identify parts and trace power flow through a clutch, manual transmission, and differential and manual transaxle assembly	• observed performance related to: – identification of the parts/components of drive train utilizing manual transmission/transaxle – tracing the flow of power through a manual transmission/transaxle *Assessment Tool* *Task Assessment Checklist: Transmissions/ Transaxles, Part 2, MEC2140–1* *Standard* *Performance rating of 2 on each criteria*	30

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MODULE MEC2140: TRANSMISSIONS/TRANSAXLES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **inspect, diagnose, service and repair clutch, manual transmission or manual transaxle assemblies**	• observed performance related to: – inspection of a manual drive train – diagnosis of system faults in a manual drive train – service of a manual drive train – repair or replacement of a clutch assembly – disassembly, inspection and reassembly of a manual transmission. *Assessment Tool* *Task Assessment Checklist: Transmissions/ Transaxles, Part 3, MEC2140–1* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures • identify back problems associated lifting heavy objects.	Be aware of WHMIS regulations and appropriate cleaning/servicing techniques when working with asbestos parts.
Identification/ Function	• describe the operation of a clutch assembly, a manual transmission and a manual transaxle during various modes of vehicle operation • describe the relationship that the clutch and manual gear box have to other parts of the drive train • identify the parts of the assemblies, using the proper technical terms.	

MODULE MEC2140: TRANSMISSIONS/TRANSAXLES (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • for each gear, identify the path of power through transmission or transaxle and compare the gear ratio of each power routing as well as the direction of rotation.	
Inspection/Report	• demonstrate how to: – check clutch pedal operation, travel and free play adjustment – remove clutch inspection cover and check for wear to the clutch disc and pressure plate, as well as other visually available parts – inspect clutch linkage for faults and/or wear – inspect shifting linkages for any undue looseness or signs of wear – check lubricant for level, type and recommended change interval – inspect mounts, braces and isolator cushions for wear fatigue or damage – inspect the assembly for leakage and note location and seal at fault – prepare a repair cost estimate, prior to commencement of repairs, as identified during inspection or servicing.	
Identify/Analyze	• formulate probable causes for typical problems that develop with clutches: – grabbing – slipping – failing to release – noise when disengaged – noise when engaging • where possible, relate the hypothetical situation to a real vehicle condition	Where possible, relate the hypothetical situation to a real vehicle condition.

MODULE MEC2140: TRANSMISSIONS/TRANSAXLES (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • formulate probable causes for typical problems that develop with manual gear boxes: – gears clashing – hard shifting – jumps out of gear – noises in specific gears – unable to engage gears – shifter noisy or loose – bearing noises.	Where possible, relate the hypothetical situation to a real vehicle condition.
Inspect/Service and Repair	• perform the clutch repairs as identified and estimated to the teacher and agreed upon by the owner of the vehicle AND/OR • remove and reinstall a clutch disc, pressure plate assembly, pilot bearing and throw-out bearing; check each part to confirm the continued serviceability of the assembly and clean each part before reassembly. Adjust linkage to specified clearances • adjust clutch linkage for correct free play at pedal or, in the case of an automatic clutch adjuster, confirm the operation as being correct	Does not imply a complete overhaul (refer to MEC3130 Automatic Transmissions).
	• follow through on agreed-upon transmission/ transaxle repairs, identified and estimated to the teacher and the owner of the vehicle AND/OR • disassemble, inspect and reassemble a three- or four-speed manual transmission with external linkage and constant mesh gearing	Does not imply a complete overhaul (refer to MEC3130 Automatic Transmissions).
	• replace manual transmission lubricant with specified type.	As per manufacturer's recommendations.
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2150: **SUSPENSION SYSTEMS**

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC1150 Ride & Control Systems

Module Description: Students develop the knowledge, skills and attitudes necessary to service and maintain vehicle suspension systems.

Module Parameters: Access to suspension systems, specialized suspension tools and related resources.
Note: Customer work must be checked by certified technician.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when working on suspension systems	• observed performance related to: – safe use of equipment, tools, materials, and supplies when working on suspension systems – use of personal protective equipment – use of safety devices and materials to protect vehicle against damage. *Assessment Tool* *Task Assessment Checklist: Suspension Systems, Part 1, MEC2150–1* *Standard* *Performance rating of 2 on each criteria*	15
• identify the purpose and function of suspension parts	• observed performance related to: – identification of suspension parts – a statement of the purpose and function of suspension parts. *Assessment Tool* *Task Assessment Checklist: Suspension Systems, Part 2, MEC2150–1* *Standard* *Performance rating of 2 on each criteria*	15

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MODULE MEC2150: SUSPENSION SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify worn or defective suspension parts	• observed performance on a given vehicle: – identification of worn and defective suspension components – determining reason for worn and/or defective suspension components – determining driveability problems caused by worn/defective suspension parts – identify tolerances and indicators of defective parts. *Assessment Tool* *Task Assessment Checklist: Suspension Systems, Part 3, MEC2150–1* *Standard* *Performance rating of 2 on each criteria*	25
• service a suspension system	• observed performance related to: – service of a suspension system – use of tools/ equipment/materials and resources – removal and replacement of suspension components. *Assessment Tool* *Task Assessment Checklist: Suspension Systems, Part 4, MEC2150–1* *Standard* *Performance rating of 2 on each criteria*	45
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC2150: SUSPENSION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures when working on suspensions components.	Be aware that coil springs exert a tremendous force, and special procedures and equipment are required to prevent serious injury when servicing.
Identification/ Function	• describe the basic types of front and rear suspensions used on motor vehicles; e.g., short, long arm suspension and MacPherson strut • compare the advantages and disadvantages of using separate and integral frames in relation to suspension design, repair and servicing • explain the advantage of using a: – solid "I" beam – split "I" beam – independent front suspension and a: • rigid • independent rear suspension • explain why it is important to reduce the amount of unsprung weight • list the positive and negative features of using coil, leaf, torsion, rubber biscuit and air springs • explain the meaning of spring rate and travel • list basic types and describe operation of shock absorbers, mounting techniques and methods of testing • explain how shock absorber ratio is calculated.	Compare gas shocks to oil-filled shock absorbers.
Inspect/Service	• describe typical wheel bearing faults; e.g., bent cage, etching, overheating and worn seal • repack a front or rear wheel bearing • lubricate suspension joints where necessary • inspect suspension components for damage and wear • explain how ball joints are checked for wear.	

MODULE MEC2150: SUSPENSION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Inspect/Service and Repair	• remove and replace: – a shock absorber – a coil spring – a ball joint – a strut.	On road-licenced vehicle, have final inspection done by certified personnel Review hazards associated with work on suspension components.
Consumer Awareness	• identify the appropriate lifting and towing procedures relative to electronically controlled suspension systems.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2160: STEERING SYSTEMS

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC1150 Ride & Control Systems

Module Description: Students develop the knowledge, skills and attitudes necessary to maintain a steering system.

Module Parameters: Access to steering systems, specialized steering tools and related resources. **Note:** Customer work must be checked by certified technician.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate safe work practices when working on steering systems**	• observed performance related to: – safe use of equipment, tools and supplies – use of personal protective equipment – use of safety devices to protect vehicles against damage. *Assessment Tool* *Task Assessment Checklist: Steering Systems, Part 1, MEC2160–1* *Standard* *Performance rating of 2 on each criteria*	10
• **identify different steering system designs and applications**	• observed performance related to: – identifying three or more common steering designs and applications – listing the advantages and limitations of steering designs – knowledge of the evolution of steering designs – identifying steering components and their function. *Assessment Tool* *Task Assessment Checklist: Steering Systems, Part 2, MEC2160–1* *Standard* *Performance rating of 2 on each criteria*	15

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **list driving symptoms that indicate worn or defective steering parts**	• observed performance related to: – recognition of driving symptoms and their connection to worn/defective steering parts – evaluation of specifications and measurements to locate worn/defective parts – analysis of parts to determine cause of wear and/or malfunction of steering parts. *Assessment Tool* *Task Assessment Checklist: Steering Systems, Part 3, MEC2160–1* *Standard* *Performance rating of 2 on each criteria*	20
• **service/repair a vehicle steering system**	• observed performance related to: – identification of worn/defective steering systems and their components – procedures followed during service and repair to steering systems – retrieval and use of specifications and measurements in servicing and repairing steering systems – removal and replacement of steering components. *Assessment Tool* *Task Assessment Checklist: Steering Systems, Part 4, MEC2160–1* *Standard* *Performance rating of 2 on each criteria*	55
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC2160: STEERING SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures when working on steering systems, and explain the importance of proper adjustments and torques.	Never apply heat to steering components or reuse damaged parts.
Identification/ Function	• identify common types of steering gear used to create the necessary mechanical advantages to overcome tire resistance; e.g.: – worn and sector – Ross cam and lever – recirculating ball – rack and pinion • identify and compare the operation of two or more steering boxes • describe the steering linkage used with rack and pinion and recirculating ball type systems • describe the construction of a tie rod assembly and explain how it is built to accommodate up and down as well as lateral movement • explain the operation of four-wheel steering and outline the advantages of this type of steering over a conventional two-wheel system.	
Inspect/Service	• show how to: – complete a work order form – check and adjust power steering fluid level – check the lubricant level in a manual steering gear and add the appropriate lubricant if necessary – lubricate steering parts – clean and inspect steering linkage for wear and replace if necessary – inspect steering joints, bushings and replace if necessary – adjust a manual steering gear – inspect and service rack and pinion steering gear – inspect and service power steering components.	On road-licenced vehicles must have final inspection done by certified personnel.

MODULE MEC2160: STEERING SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Consumer Awareness	*The student should:* • list symptoms of worn or defective components • list factors that create premature steering failures.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2170: METAL REPAIR & FINISHING

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC1170 Metal Forming & Finishing

Module Description: Students analyze and repair metal damage.

Module Parameters: Access to gas metal arc welding (GMAW) and oxyacetylene welding (OAW) welders, basic body hand/power tools and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices when metal forming and finishing metal damage	• observed performance related to: – following shop procedures – selecting and using metal working, welding and hydraulic equipment. *Assessment Tool* *Task Assessment Checklist: Metal Repair & Finishing, Part 1, MEC2170–1* *Standard* *Performance rating of 2 on each criteria*	10
• identify different damage conditions and repair procedures for metal damage	• use of appropriate resources to produce a report describing: – direct damage – indirect damage – repair procedures. *Assessment Tool* *Task Assessment Checklist: Metal Repair & Finishing, Part 2, MEC2170–1* *Standard* *Performance rating of 2 on each criteria*	25

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MODULE MEC2170: METAL REPAIR & FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• repair metal damage to a vehicle	• observed performance related to: – problem solving a repair – developing sequence of repair – using metal, welding and finishing equipment – repairing major sheet metal damage – repairing large rust out. *Assessment Tool* *Task Assessment Checklist: Metal Repair & Finishing, Part 3, MEC2170–1* *Standard* *Performance rating of 2 on each criteria*	65
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate safe practices in relation to: – use of welding equipment – use of solder and soldering equipment – sheet metal straightening system.	Address personal, property and environmental safety. Demonstrate hydraulic pulling and come-along equipment.
Identify/Analyze	• identify and describe type/extent of minor sheet metal damage • list sequence of repair • identify and describe major sheet metal impact damage conditions: – direct damage – indirect damage • list sequence of repair.	Discuss work hardening, tears, gouges, buckles, pressure forces and aluminum versus ferrous sheet metal.

MODULE MEC2170: METAL REPAIR & FINISHING (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Repair	*The student should:* • demonstrate how to: – perform metal straightening – perform metal replacement work – repair damaged aluminum panel – repair a panel using body solder – complete a large rust out repair	May only be possible to do a partial panel. Link module to a CTR project to complete a more extensive panel repair.
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC2180: **TRIM REPLACEMENT**

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: None

Module Description: Students demonstrate the removal and repair of trim parts, with an emphasis on removal and installation without damage.

Module Parameters: Access to specialized trim tools and related resources.

Supporting Module: MEC1190 Surface Preparation 1

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe use of tools and chemicals for trim replacement	• observed performance in: – following shop procedures pertaining to use of tools and chemicals. *Assessment Tool* *Task Assessment Checklist: Trim Replacement, Part 1, MEC2180–1* *Standard* *Performance rating of 2 on each criteria*	10
• investigate interior and exterior trim systems used to enhance appearances	• presentation of a report describing: – interior/exterior trim materials – functions and arrangement of window and door lock hardware/parts – fasteners unique to interior/exterior. *Assessment Tool* *Task Assessment Checklist: Trim Replacement, Part 2, MEC2180–1* *Standard* *Performance rating of 2 on each criteria*	10
• remove and install trim and weather-stripping	• observed performance related to: – interior door trim removal and installation – exterior trim removal and installation – use of trim tools. *Assessment Tool* *Task Assessment Checklist: Trim Replacement, Part 3, MEC2180–1* *Standard* *Performance rating of 2 on each criteria*	45

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MODULE MEC2180: TRIM REPLACEMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **analyze and install enhancement trim**	• observed performance related to a given vehicle: – analyze and propose enhancement trim – application of new trim, accessories, decals, vinyl overlays. *Assessment Tool* *Task Assessment Checklist: Trim Replacement, Part 4, MEC2180–1* *Standard* *Performance rating of 2 on each criteria*	20
• **identify further education and career opportunities related to trim replacement and repair services**	• presentation of a report on career choices related to: – glass installation/removal – trim installation – accessory centres. *Assessment Tool* *Assessment Guide: Career Profile, MECCR* *Standard* *Performance rating of 2 on each criteria*	15
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• identify hazards involved when working with trim.	Personal, property and environment.

MODULE MEC2180: TRIM REPLACEMENT (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analysis	*The student should:* • identify the materials used for interior trim, the fastening system for each and describe the correct method of removal • describe the methods to remove and install interior trim • describe precautions to be adhered to when removing and installing trim • describe methods used to attach trim accessories, door locks, mirrors, etc. • explain how to remove and replace specified trim • identify fasteners specific to exterior trim, including clips and adhesives • explain the inherent value of decals, vinyl and overlays • describe procedures for removal of decals, vinyl and overlays • describe the function of weather-stripping • identify two or three different methods of weather-stripping and explain the significance of the differences • identify two or three procedures needed to remove accessories and implications for repair or replacement.	
Inspect/Repair	• demonstrate correct procedures and tools used in the removal of moldings, emblems and accessories • install selected exterior trim • successfully remove and install a door seal, test seal and adjust hardware accordingly • service accessories considered to be trim; e.g., locks, mirrors, lights.	
Careers	• identify further education, work conditions and opportunities.	

MODULE MEC2190: SURFACE PREPARATION 2

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC1190 Surface Preparation 1

Module Description: Students perform advanced surface preparations.

Module Parameters: Access to auto body hand/power tools related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe practices when performing advanced surface preparation	• observed performance related to: – following safe practices and use of proper personal protective equipment – following shop routines – use of WHMIS bulletins with respect to surface preparation. *Assessment Tool* *Task Assessment Checklist: Surface Preparation 2, Part 1, MEC2190–1* *Standard* *Performance rating of 2 on each criteria*	10
• explain materials and practices for performing advanced surface preparation	• observed performance in: – listing and identifying metals/metal condition and respective preparation techniques – listing and identifying plastics and respective preparation techniques – listing abrasives and identifying application – listing and describing chemical use in surface preparation – listing coatings and application techniques and processes. *Assessment Tool* *Task Assessment Checklist: Surface Preparation 2, Part 2, MEC2190–1* *Standard* *Performance rating of 2 on each criteria*	40

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MODULE MEC2190: SURFACE PREPARATION 2 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• carry out an advanced surface preparation	• observed performance related to: – analyzing and determining preparation process – use of chemical preparation – application of coatings – compounding a surface. *Assessment Tool* *Task Assessment Checklist: Surface Preparation 2, Part 3, MEC2190–1* *Illustrative Example: Surface Preparation 2, MEC2190-2* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate safe practices in relation to chemicals.	Personal, property and environment. WHMIS; check with supplier for handling procedures.
Identify/Analyze	• identify specific metal treatments, such as: – aluminum – plymetal – galvanized – other • identify equipment, materials and accepted procedures in compounding surfaces • match adhesion promoters to type of plastic being finished	Aluminum; plymetal; galvanized; new anodized aluminum. Prepare metal replacement parts. Spot repair; adjacent panel matching.

MODULE MEC2190: SURFACE PREPARATION 2 (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • use correct cleaning agent to match plastics and product used • identify and describe custom masking methods.	Flexible plastic; rigid plastic; interior/exterior plastics; cleaners. Flames; elaborate striping.
Inspect/Repair	• demonstrate how to: – prepare bare metal – clean and treat surface rust as conditions dictate – compound surfaces – prime plastic and metal components – custom mask a small project.	Spot blasting; sanding; chemical treatment. Flexible filling primer; special adhesion promoters.
Careers	• identify further education, work conditions and opportunities.	

MODULE MEC2200: **REFINISHING 1**

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC2190 Surface Preparation 2

Module Description: Students demonstrate metal surface refinishing procedures.

Module Parameters: Access to spray equipment and related resources.

Supporting Module: MEC2190 Surface Preparation 2

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe practices and follow all warnings identified by product manufacturers, Workplace Hazardous Materials Information System (WHMIS), and Occupational Health and Safety	• observed performance related to: – health hazards involved in refinishing – warnings as outlined in WHMIS bulletins – following proper personal and shop safety routines. *Assessment Tool* *Task Assessment Checklist: Refinishing 1, Part 1, MEC2200–1* *Standard* *Performance rating of 2 on each criteria*	15
• identify and describe refinishing products and equipment	• presentation of a report identifying and describing: – paint spray systems (two) – paint spray techniques – problems created by improper techniques and equipment. *Assessment Tool* *Task Assessment Checklist: Refinishing 1, Part 2, MEC2200–1* *Standard* *Performance rating of 2 on each criteria*	30

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate proper refinishing application	• observed performance related to: – proper use of paint products (paint reducer/ hardener) – following demonstrated spray techniques – following proper spray procedures – proper care of spray equipment. *Assessment Tool* *Task Assessment Checklist: Refinishing 1, Part 3, MEC2200–1* *Standard* *Performance rating of 2 on each criteria*	55
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of health hazards and environmental impacts of products used • demonstrate use of personal protective equipment as recommended by manufacturer.	WHMIS; product information. MSDS Sheets available. Respirators; glove, coveralls.
Identify/Analyze	• identify types of top coats, solvents and additives • identify and select colour and type of paint on a given vehicle • demonstrate knowledge of proper procedure in paint preparation. • inspect pre-paint project and determine deficiencies • identify basic spray gun types • show how to troubleshoot spray gun	Mixing measurements; additive, solvents; agitation. Masking, surface preparation to acceptable standards. Suction feed; gravity feed; pressure pot and HVLP paint guns.

MODULE MEC2200: REFINISHING 1 (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • demonstrate knowledge of refinishing equipment accessories • demonstrate knowledge of proper top coat application techniques • show how to troubleshoot basic application problems.	Size and type of air lines; air cleaning and control devices. Dry spray; runs, etc.
Investigate/Repair	• prepare booth for spraying • prepare and apply top coat • demonstrate knowledge of and perform cleaning of spray guns • perform final detailing: – removal of masking tape – check and correct surface defects – final cleaning and inspection.	Cleanliness; anti-static systems. Polishing if required.
Careers	• identify further education, work conditions and opportunities.	

MODULE MEC2210: **TOUCH-UP & FINISHING**

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC2200 Refinishing 1

Module Description: Students determine and use the appropriate materials, tools and processes for minor surface repairs.

Module Parameters: Access to spray equipment and related resources.

Supporting Module: MEC1160 Structures & Materials

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **practise safe handling, use and disposal of hazardous touch-up and finishing products**	• observed performance related to: – safe handling of refinish products – proper use of refinish tools and equipment – following correct safety routines in disposal and clean-up of hazardous materials. *Assessment Tool* *Task Assessment Checklist: Touch-up & Finishing, Part 1, MEC2210–1* *Standard* *Performance rating of 2 on each criteria*	15
• **identify the techniques and products required to complete a minor surface repair**	• given a repair problem demonstrate: – ability to outline a spot repair procedure – knowledge of repair procedures and products – proper use of primers, putties and cleaners – listing tools and equipment required for spot repair. *Assessment Tool* *Task Assessment Checklist: Touch-up & Finishing, Part 2, MEC2210–1* *Standard* *Performance rating of 2 on each criteria*	40

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MODULE MEC2210: TOUCH-UP & FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate the skills required to prepare and refinish a spot repair**	• observed performance related to: – preparing spot repair for painting – selection of paint by code to match colour – application of paint following prescribed techniques. *Assessment Tool* *Task Assessment Checklist: Touch-up & Finishing, Part 3, MEC2210–1* *Standard* *Performance rating of 2 on each criteria*	45
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of the safety precautions required for: – feather edging with dual action orbital sanders – handling of primer products and putties – spraying primers.	Personal, property and environment.
Identify/Analyze	• identify the imperfections in paint or freshly prepared surfaces; e.g., sand scratches, runs, dry spray, orange peel, "bull's eye," sags, chips • demonstrate the spot repair concepts as required by industry including colour matching concepts of two types of paint: – solids – metallics • describe the advantages of the base/clear system of paint in colour matching.	

MODULE MEC2210: TOUCH-UP & FINISHING (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Repair	*The student should:* • perform a surface flaw repair of a painted panel, using sandpaper and compounds without repainting • prepare a panel for a spot repair and follow appropriate instructions in application of primer and paint • show proper procedure in the application and sanding of putties.	
Career Exploration	• identify further education and work opportunities related to touch-up and repair.	Chip repair and air brush use.

MODULE MEC2220: INTERIOR REPAIRS

Level: Intermediate

Theme: Suspension and Structural Systems

Prerequisite: MEC1160 Structures & Materials

Module Description: Students search for and use the appropriate products and techniques to maintain vehicle interior surface materials.

Module Parameters: Access to interior materials, products, tools, equipment and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• practise safe handling, use and disposal of hazardous cleaning and repair products	• observed performance related to: – proper handling of volatile chemicals – proper disposal of environmentally unfriendly chemicals – following procedures necessary for protection of vehicle and persons. *Assessment Tool* *Task Assessment Checklist: Interior Finishes & Repairs, Part 1, MEC2220–1* *Standard* *Performance rating of 2 on each criteria*	20
• analyze type of repair or restoration required, and identify the techniques/ products necessary to repair and/or restore an interior surface	• given samples of interior material: – identify and describe usage – describe proper care with products and procedures – relate common stains, spots and soils to methods needed for removal. *Assessment Tool* *Task Assessment Checklist: Interior Finishes & Repairs, Part 2, MEC2220–1* *Standard* *Performance rating of 2 on each criteria*	35

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MODULE MEC2220: INTERIOR REPAIRS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• clean and/or repair an interior surface	• observed performance in completion of an interior clean and repair: – outlining steps/procedures required to restore a given surface – select and use tools and materials to complete a simple repair – select and use materials to clean an interior surface. *Assessment Tool* *Task Assessment Checklist: Interior Finishes & Repairs, Part 3, MEC2220–1* *Standard* *Performance rating of 2 on each criteria*	45
• demonstrate basic competencies.	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow safety rules and procedures for the products used for interior care • identify hazards associated with the improper use of certain volatile chemicals.	Personal, property and environment.

MODULE MEC2220: INTERIOR REPAIRS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze	• identify cleaners for the following materials: – leather – cloth – vinyl – rubber – plastic – polyurethane foam	
	• describe the correct procedures and products that can safely be used for cleaning and maintenance, including volatile cleaners, neutral soaps and specialty products	Non-silicon products.
	• compile an identification of interior parts and clean the parts to like-new condition or "best as can be expected," depending on condition. Include glass in the cleaning	
	• identify and describe the nature of stains: soil, grease, oil, tar, blood, wax, chocolate and non-chocolate candy	
	• identify correct procedures for removal of three of the above	
	• compile a chart showing the stain-removal procedures, including special products, if required.	
Inspect/Repair	• replace the vinyl or cloth covering on a door rest • complete a vinyl or plastic repair of a crack or hole in an interior part and refinish • successfully remove and replace weather stripping in either a door glass area or door opening • identify signs of poor sealing by weather stripping and adjust if possible.	
Career Exploration	• identify further education and career opportunities related to interior finishes and repairs.	

MODULE CURRICULUM AND ASSESSMENT STANDARDS

SECTION F: ADVANCED LEVEL

The following pages define the curriculum and assessment standards for the advanced level of Mechanics.

> Advanced level modules demand a higher level of expertise and help prepare students for entry into the workplace or a related post-secondary program.

Module MEC3010 Buying & Selling Vehicles F.3
Module MEC3020 Vehicle Value Appraisal F.7
Module MEC3030 Engine Diagnosis F.11
Module MEC3040 Engine Tune-up F.15
Module MEC3050 Engine Replacement F.19
Module MEC3060 Engine Reconditioning 1 .... F.23
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Module MEC3080 Alternate Energy Systems F.31
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Module MEC3200 Refinishing 2 .... F.77
Module MEC3210 Plastic & Fibreglass F.81
Module MEC3220 Glass Replacement F.85
Module MEC3230 Refinishing 3 .... F.89

MODULE MEC3010: BUYING & SELLING VEHICLES

Level: Advanced

Theme: Vehicle Design and Ownership

Prerequisite: None

Module Description: Students develop the skills required to make an informed purchase or sale of a vehicle.

Module Parameters: Access to new and used vehicle reports and other related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• investigate and determine the type of vehicle that best meets a defined need	• a report indicating: – reasons for selecting a particular type of vehicle – how vehicle will meet financial, emotional and service constraints. *Assessment Tool* *Task Assessment Checklist: Buying & Selling Vehicles, Part 1, MEC3010–1* *Standard* *Performance rating of 3 on each criteria*	15
• evaluate and describe the condition of a vehicle	• inspection and comparison of selected vehicle to predetermined criteria. *Assessment Tool* *Task Assessment Checklist: Buying & Selling Vehicles, Part 2, MEC3010–1* *Standard* *Performance rating of 3 on each criteria*	35
• plan a strategy to sell or buy a vehicle	• planned strategy: – outlining steps in selling or buying a vehicle – determining the value of the vehicle – advertising for or promoting a vehicle. *Assessment Tool* *Task Assessment Checklist: Buying & Selling Vehicles, Part 3, MEC3010–1* *Standard* *Performance rating of 3 on each criteria*	25

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MODULE MEC3010: BUYING & SELLING VEHICLES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **recognize the legal rights and responsibilities of both the seller and purchaser**	• investigation of legal implications/obligations involved in: – buying a vehicle – selling a vehicle. *Assessment Tool* *Task Assessment Checklist: Buying & Selling Vehicles, Part 4, MEC3010–1* *Standard* *Performance rating of 3 on each criteria*	15
• **identify safety concerns and regulations when buying and selling vehicles that have been repaired after an accident**	• identification of safety-related concerns when: – buying a vehicle – selling a vehicle that has had extensive repairs because of an accident. *Assessment Tool* *Task Assessment Checklist: Buying & Selling Vehicles, Part 5, MEC3010–1* *Standard* *Performance rating of 3 on each criteria*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• identify safety concerns when dealing with unfamiliar vehicles.	

MODULE MEC3010: BUYING & SELLING VEHICLES (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Consumer Awareness	• identify the factors that affect the choice of a vehicle, such as: – intended use and length of service – required performance and economy – funds or financing available – emotional appeal – consumer reports	
	• describe the advantages and disadvantages of purchasing a vehicle: – privately – by auction – through dealers – lease agencies – rental agencies – government agencies	
	• identify the parts of a vehicle that can be inspected by: – visual means – road testing – instrument checks	Consider engine, brakes, steering and body components.
	• prepare an offer to purchase including: – condition and age of the vehicle – dealer cost – profit level – value of trade in – cost of financing – ability to pay or make payment – possible liens	Read and discuss the conditions of sale commonly used in new and used vehicle dealerships. Discuss the legal implications of a lien on a vehicle.
	• select or recommend a seller based on: – the seller's reputation – ability to service – willingness to back the product – number of vehicles to choose from.	
Inspect/Service	• clean and restore the appearance of the vehicle to next to new standards • organize and prepare a record of the vehicle's service and maintenance record	Could be combined with MEC1020 Vehicle Service & Care and MEC2010 Vehicle Detailing.

MODULE MEC3010: BUYING & SELLING VEHICLES (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Service (continued)	*The student should:* • calculate the value of a vehicle by: – having it appraised by more than one experienced individual – comparing the appraisal to published prices – calculating the value through depreciation – comparing the asking price of similar vehicles • describe the advantages of selling a vehicle: – on consignment – privately – on a trade • identify legal steps when buying and selling a vehicle.	Information can be gained from a new and used car dealer. The Blue Book is one of the published sources that provides a price guide.
Careers	• identify career opportunities related to: – vehicle sales – appraisals – financing.	

MODULE MEC3020: VEHICLE VALUE APPRAISAL

Level: Advanced

Theme: Vehicle Design and Ownership

Prerequisite: MEC2020 Vehicle Maintenance

Module Description: Students demonstrate the procedures used by industry to estimate the cost of a repair and the market value of a vehicle.

Module Parameters: Access to new and used vehicle reports and other related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures when inspecting vehicles	• observed performance in: – following established shop/lab routines – safety and care as related to vehicle inspections. *Assessment Tool* *Task Assessment Checklist: Vehicle Value Appraisal, Part 1, MEC3020–1* *Standard* *Performance rating of 3 on each criteria*	10
• inspect a vehicle to determine its overall condition and repair requirements	• observed performance while completing an inspection: – covering all systems – reporting required service/repair – estimating costs of required service/repair. *Assessment Tool* *Task Assessment Checklist: Vehicle Value Appraisal, Part 2, MEC3020–1* *Standard* *Performance rating of 3 on each criteria*	35
• apply standards used by the vehicle repair industry to appraise the condition and value of a vehicle	• creation of vehicle appraisal using industry standards. *Assessment Tool* *Task Assessment Checklist: Vehicle Value Appraisal, Part 3, MEC3020–1* *Standard* *Performance rating of 3 on each criteria*	45

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MODULE MEC3020: VEHICLE VALUE APPRAISAL (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• outline the best business practices to follow when situations of uncertainty or conflicting interests occur relative to an appraisal	• outlining business practices to follow during problematic situations. *Assessment Tool* *Task Assessment Checklist: Vehicle Value Appraisal, Part 4, MEC3020–1* *Standard* *Performance rating of 3 on each criteria*	10
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow predetermined shop guidelines when working on or around vehicles.	
Identify/Analyze	• investigate and report on the condition of a vehicle using a comprehensive method, including owner interview and inspection report completion • examine and report on the system(s) that require repair to determine the extent of reconditioning required to return the system(s) to serviceability • construct a basis for vehicle valuation by determining the vehicle characteristics that would contribute to market value (e.g., year, make, model, options, mileage, relative condition, emotional appeal and popularity) • complete an evaluation checklist	

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze (continued)	• list probable and possible parts required to effect a complete repair using original equipment (OEM), aftermarket and used parts	Include the repair estimate of cost, any shop supply, taxes or other charges that would contribute to the total estimated price.
	• using accepted industry labour guide, calculate the correct labour charges for the required parts replacements, considering all modifications or options to the subject vehicle	
	• identify the wholesale value of a subject vehicle using the accepted wholesale reference guides	Compare, Red Book, Black Book, Blue Book figures.
	• calculate the market value of a subject vehicle by comparative pricing on three similar vehicles in the local marketplace	Use Alberta Motor Association as resource. Explore linkages with auto industry.
	• describe business practice when resolving conflicts related to estimations and evaluations.	Use consumer guide.
Inspect/Report	• describe the economics of repairing a vehicle considering all factors affecting market resale evaluation • prepare an estimation/evaluation summary for presentation to a vehicle owner • identify the best course of completing the requested repairs ensuring the profitability of the business enterprise.	
Careers	• identify further education and work opportunities related to vehicle value appraisal.	

MODULE MEC3030: ENGINE DIAGNOSIS

Level: Advanced

Theme: Propulsion Systems

Prerequisite: MEC1040 Engine Fundamentals

Module Description: Students learn to diagnose the condition of an engine for worn or damaged parts and/or improper adjustments.

Module Parameters: Access to vehicle engine, diagnostic test equipment and related resources.

Supporting Modules:
MEC2030 Lubrication & Cooling
MEC2040 Fuel & Exhaust Systems
MEC2060 Ignition Systems
MEC2070 Emission Controls

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe working practices while conducting an engine performance diagnosis	• observed performance in: – following safe lab practices – recognizing and controlling potential hazards during engine diagnosis. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• diagnose the condition of an operating engine, using body senses (touch, sight, hearing),	• observed performance in demonstrating ability to diagnose engine faults by using: – sense of touch – sense of sight – sense of hearing. *Assessment Tool* *Task Assessment Checklist: Engine Diagnosis, Part 1, MEC3030–1* *Standard* *Performance rating of 3 on each criteria*	25

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MODULE MEC3030: ENGINE DIAGNOSIS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• assess engine conditions, using specialized test equipment and on-board diagnostic systems	• observed performance in using equipment to determine the condition of a given engines: – ignition systems – fuel system – cooling/exhaust system – emission control system – mechanical system. *Assessment Tool* *Task Assessment Checklist: Engine Diagnosis, Part 2, MEC3030–1* *Laboratory Problem Solving, MECLPS* *Standard* *Performance rating of 3 on each criteria*	50
• provide a report that describes the condition of an engine	• report generated to reflect the true condition of a given engine. *Assessment Tool* *Task Assessment Checklist: Engine Diagnosis, Part 3, MEC3030–1* *Illustrative Example: Engine Diagnosis, MEC3030–2* *Standard* *Performance rating of 3 on each criteria*	15
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate safety while diagnosing engines.	

MODULE MEC3030: ENGINE DIAGNOSIS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze	• list possible engine problems based on information provided • describe through listening, observing, touching a running and/or stopped engine, whether abnormalities exist.	Owner complaints. For example, noises, blow-by, oil leaks, loose connections/ parts, oil/coolant conditions, belts, hoses and filters.
	• identify engine type and manufacturer's specifications • show how to: – analyze intake manifold vacuum – check ignition timing and advance mechanisms – check for proper idle speeds – check engine oil pressure – check cylinder compression readings – check exhaust emissions • identify any abnormalities on the vehicle, using gauges and lights, including self-diagnostics • use an engine analyzer and/or computerized tester to describe the condition of various engine systems as per capability of the test unit	
	• compile all information and generate a report for the customer outlining defects found and recommended corrections.	Students generate their own format.
Careers	• identify further education and career opportunities related to engine performance and diagnosis.	

MODULE MEC3040: ENGINE TUNE-UP

Level: Advanced

Theme: Propulsion Systems

Prerequisite: MEC3030 Engine Diagnosis

Module Description: Students diagnose, service and repair engine, fuel, ignition, charging and starting systems.

Module Parameters: Access to engine diagnostic equipment and supporting resources.

Supporting Modules:
MEC2030 Lubrication & Cooling
MEC2040 Fuel & Exhaust Systems
MEC2060 Ignition Systems
MEC2070 Emission Controls
MEC2090 Electrical Components
MEC3030 Engine Diagnosis

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices while performing an engine tune-up	• observed performance in: – following shop/lab established procedures – recognizing and observing aspects that protect equipment and the vehicle. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• determine the mechanical condition of an engine	• observed performance in the use of equipment and results obtained in determining mechanical condition of an engine. *Assessment Tool* *Task Assessment Checklist: Engine Tune-up, Part 1, MEC3040–1* *Illustrative Example: Engine Tune-up Part 1 MEC3040–2* *Standard* *Performance rating of 3 on each criteria*	15

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MODULE MEC3040: ENGINE TUNE-UP (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• check and service a carburetor and a fuel injection system	• observed performance in servicing fuel systems including: – carburetors – fuel injectors – related components. *Assessment Tool* *Task Assessment Checklist: Engine Tune-Up, Part 2, MEC3040–1* *Illustrative Example: Engine Tune-Up Part 2 MEC3040–2* *Standard* *Performance rating of 3 on each criteria*	25
• use diagnostic equipment to check, interpret and service ignition, charging, starting, emission control and exhaust systems	• observed performance in use of equipment to check, interpret and service engine ignition, charging, starting, emission and exhaust systems. *Assessment Tool* *Task Assessment Checklist: Engine Tune-Up, Part 3, MEC3040–1* *Illustrative Example: Engine Tune-Up Part 3 MEC3040–2* *Standard* *Performance rating of 3 on each criteria*	50
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow lab safety procedures.	Personal, property and environment.

MODULE MEC3040: ENGINE TUNE-UP (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze	*The student should:* • show how to: – perform a static and dynamic compression test to determine mechanical condition of an engine – do a leak down test • record and analyze results.	
Inspect/Service and Repair	• identify whether a carburetor problem exists and document specific faults • demonstrate how to: – remove, clean and adjust a carburetor – check and/or replace filters – test fuel pump pressure and capacity – clean fuel injectors – use diagnostic equipment to diagnose ignition system – service spark plugs, wires, distributor cap, rotor, points, pick-up coil, spark advance – check and adjust ignition timing – operate starter and determine if problem exists (noises, drive engagement, speed, etc.) – check starter amperage draw and correct – check starter circuit voltage drops and correct – check battery condition, and service – do a visual check; i.e., wires, connections, belt condition/tension – check alternator for noise, vibration – check alternator output and voltage regulation and correct – check charging circuit voltage drops and correct faults – diagnose computer controlled systems and document faults	Diagnostic equipment required.

MODULE MEC3040: ENGINE TUNE-UP (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Inspect/Service and Repair (continued)	– identify which emissions are being controlled – identify what emission control devices exist on vehicle – identify to what standards these devices control emissions – check if vehicle meets standards and correct	If equipment is available.
	– road test vehicle to determine engine performance and driveability – compile a report outlining test results, work done and present condition of engine and related parts/systems.	Diagnostic printout.
Careers	• identify further education and work opportunities related to engine tune-ups.	

MODULE MEC3050: ENGINE REPLACEMENT

Level:	Advanced
Theme:	Propulsion Systems
Prerequisite:	MEC1040 Engine Fundamentals
Module Description:	Students remove and install an engine in a chassis.
Module Parameters:	Access to an engine lift, tools/equipment and supporting instructions and resources.
Supporting Modules:	MEC3030 Engine Diagnosis MEC3040 Engine Tune-up

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• use engine lifting equipment and related tools safely	• observed performance in: – application and use of lifting tools and equipment – safely removing and installing an engine – following established shop/lab routines. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• identify steps involved to prepare a vehicle for engine removal	• determination of: – how engine will be removed – the order of steps to be taken to remove an engine. *Assessment Tool* *Task Assessment Checklist: Engine Replacement, Part 1, MEC3050–1* *Illustrative Example: Replacement, MEC3050–2* *Standard* *Performance rating of 3 on each criteria*	15
• apply mechanical skills to remove and replace engine accessories	• removing and replacing engine accessories and related components for a given a vehicle. *Assessment Tool* *Task Assessment Checklist: Engine Replacement, Part 2, MEC3050–1* *Standard* *Performance rating of 3 on each criteria*	20

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MODULE MEC3050: ENGINE REPLACEMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **apply mechanical skills to remove and install an engine in a chassis**	• observed performance in removing and installing an engine. *Assessment Tool* *Task Assessment Checklist: Engine Replacement, Part 3, MEC3050–1* *Standard* *Performance rating of 3 on each criteria*	30
• **perform post engine installation start-up and adjustment procedures**	• observed performance in post-engine installation start-up and adjustments. *Assessment Tool* *Task Assessment Checklist: Engine Replacement, Part 4, MEC3050–1* *Standard* *Performance rating of 3 on each criteria*	25
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of types of lifting tools/equipment available for engines • demonstrate knowledge of where to attach devices • explain procedures to follow to remove and install an engine • describe and follow precautions when working with vehicle equipped with air conditioning.	Review hazards associated with lifting engines. Tool, bolt size, location and torque.

MODULE MEC3050: ENGINE REPLACEMENT (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze	*The student should:* • explain how to prepare a vehicle for engine removal • identify all wiring, hoses, cables, pipes that require disconnecting • identify units and special fasteners that will be removed.	Pay attention to paint protection; scribing/ marking components. Masking, labelling and photographic techniques. With or without transmission, motor mounts.
Inspect/Service	• disconnect and service battery • drain and dispose of lubricant and coolant • remove appropriate wires, hoses, cables, pipes, units • remove and/or install an engine • dismantle/assemble an engine • install lubricants/coolant • service and store battery • drain/store or dispose fluids • identify the most appropriate method and remove and replace the following: – wires – cables – hoses – pipes – accessories – cylinder head – cylinder block • adjust and service engine	Blocking fuel line; fasteners organized. Allow for rebuilt components to be used such as heads and short blocks assemblies. Have students be aware of gasoline removal and storage precautions. Organizing fasteners. Identification of disconnects for later connects. Depending on circumstance, engine may be removed as an assembly.

MODULE MEC3050: ENGINE REPLACEMENT (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Service (continued)	*The student should:* • start engine and check for proper performance • perform post-engine installation vehicle clean-up for customer pick-up.	Module maybe combined with MEC3030 Engine Diagnosis, MEC3040 Engine Tune-ups, MEC3060 Engine Reconditioning 1 MEC3070 Engine Reconditioning 2.
Careers	• identify further education and work opportunities related to engine removal and installation.	Consider trade related areas such as machinist and welder.

MODULE MEC3060: **ENGINE RECONDITIONING 1**

Level: Advanced

Theme: Propulsion Systems

Prerequisite: MEC3050 Engine Replacement

Module Description: Students determine the need for service, and perform the required service, on the cylinder head and related components of an engine.

Module Parameter: Access to cylinder head rebuilding equipment measuring tools and related resources.

Supporting Modules: MEC3030 Engine Diagnosis
MEC3040 Engine Tune-up

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work procedures related to cylinder head work	• observed performance in following: – precautions related to removal and installation of cylinder head(s) – safe practices in reconditioning cylinder head(s). *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• determine the condition of a cylinder head before and after disassembly	• a diagnostic report that: – describes the overall condition of a cylinder head – repair work/reconditioning required. *Assessment Tool* *Task Assessment Checklist: Cylinder Head Reconditioning, Part 1, MEC3060–1* *Standard* *Performance rating of 3 on each criteria*	15

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MODULE MEC3060: ENGINE RECONDITIONING 1 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• recondition a cylinder head and its related components	• observed performance in: – disassembly of a cylinder head – checking/measuring to determine condition of cylinder head, valves, seats, guides, springs – reconditioning valves, seats and guides – assembly of cylinder head and required checks—valve spring and stem heights – checking condition of related components: • rocker arms (shafts) • push rods • camshaft • lifters • sprockets, gears, chains. *Assessment Tool* *Task Assessment Checklist: Cylinder Head Reconditioning, Part 2, MEC3060–1* *Illustrative Example: Cylinder Head Reconditioning, MEC3060–2, Cylinder Head Assembly Measurement, MEC3060–3* *Standard* *Performance rating of 3 on each criteria*	60
• reassemble and install a cylinder head	• observed performance in: – reassembling a cylinder head according to manufacturer's recommended procedures – installation of cylinder head and related components observing torque and sequence, head gasket positioning and other related gaskets – adjustments related to the work. *Assessment Tool* *Task Assessment Checklist: Cylinder Head Reconditioning, Part 3, MEC3060–1* *Standard* *Performance rating of 3 on each criteria*	15
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC3060: ENGINE RECONDITIONING 1 (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures.	
Identify/Analyze	• perform checks to determine condition of cylinder head and related parts • describe blue-printing procedures for cylinder heads • calculate costs of blue-printing.	Compression test, vacuum test, valve timing, oil pressure. Reference: *Step-By-Step Engine Blue Printing*, Rick Voegelin.
Inspect/Service	• clean cylinder head and related parts • inspect parts for serviceability • machine parts • assemble cylinder head and check valve spring and stem height • service push rods, lifters, rocker arms, chain, gears and camshaft, pulleys, belts • install cylinder head and make adjustments • address unique concerns related to overhead camshaft engines • run engine and evaluate work done • adjust to specifications.	Field trips to machine shops. Cracks, warpage, guide, valve stem wear. Grind valves, seats, recondition guides. Torque, sequence, specification and techniques/valve adjustments. Stress importance of belt/ chain tension and condition.
Careers	• identify the demand for skills related to engine reconditioning.	

MODULE MEC3070: ENGINE RECONDITIONING 2

Level: Advanced

Theme: Propulsion Systems

Prerequisite: MEC3050 Engine Replacement

Module Description: Students determine the need for service, and perform service, on a cylinder block assembly and related components of an engine.

Module Parameters: Access to engine measuring tools, cylinder block reconditioning tools/equipment and related resources.

Supporting Modules:
MEC3030 Engine Diagnosis
MEC3040 Engine Tune-up
MEC3060 Engine Reconditioning 1

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work procedures while reconditioning a cylinder block	• observed performance in: – following established shop/lab routines – safely using engine reconditioning tools/equipment. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• determine the condition of a cylinder block before and after disassembly	• the ability to determine: – the need for work through inspection of cylinder block, pistons, rods, crankshaft, camshaft, bearings and other related components – cost of repair. *Assessment Tool* *Task Assessment Checklist: Cylinder Block Reconditioning, Part 1, MEC3070–1* *Standard* *Performance rating of 3 on each criteria*	25

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MODULE MEC3070: ENGINE RECONDITIONING 2 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **recondition a cylinder block and its related components**	• observed performance in reconditioning: – cylinder block – connecting rods – pistons. *Assessment Tool* *Task Assessment Checklist: Cylinder Block Reconditioning, Part 2, MEC3070–1* *Illustrative Example: Cylinder Block Reconditioning, MEC3070–2,* *Illustrative Example: Piston and Cylinder Measurement, MEC3070–3, Crankshaft and Main Bearing Measurement, MEC3070–4* *Standard* *Performance rating of 3 on each criteria*	40
• **reassemble a cylinder block assembly**	• observed performance in disassembly and assembly a cylinder block assembly. *Assessment Tool* *Task Assessment Checklist: Cylinder Block Reconditioning, Part 3, MEC3070–1* *Standard* *Performance rating of 3 on each criteria*	25
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow safety practices related to reconditioning cylinder blocks.	Personal, property and environment.

MODULE MEC3070: ENGINE RECONDITIONING 2 (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze	• list possible engine problems based on information provided • describe blue-printing procedures for cylinder blocks • estimate costs.	Refer to customer complaints and service bulletins.
Inspect/Service	• clean all engine block components • inspect the following components for serviceability: – block alignment, warpage and cracks – cylinder(s) size, taper, roundness and general condition – crankshaft bends, cracks, journal size, tapes, roundness and general condition – camshaft(s) bends, lobe/lift wear and journal size – piston(s) size, taper, clearance and condition of pin(s) and grooves – connecting rod(s) big/small end size and straightness – lifters base wear, rate of leak down – bearings size and wear – chains, sprockets, pulleys, belts – other • identify what servicing is required • machine/service components as required • assemble engine block observing proper tolerances.	Deglaze, bore, hone, resize, replace. Combine with MEC3040 Engine Tune-ups, MEC3050 Engine Replacement, for installation and running.
Careers	• identify the demand for skills related to engine reconditioning.	

MODULE MEC3080: **ALTERNATE ENERGY SYSTEMS**

Level: Advanced

Theme: Propulsion Systems

Prerequisite: MEC2050 Alternate Fuel Engines

Module Description: Students describe why vehicle manufacturers continue to build the crank-piston internal combustion gasoline engine. Students also identify and describe future engine designs.

Module Parameters: Access to support resources.

Supporting Module: MEC1040 Engine Fundamentals

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• research and describe the historical development of piston engine designs from Nickolous Otto's engine to the present	• a report generated indicating: – historical development of internal combustion engines – engine manufacturing techniques. *Assessment Tool* *Task Assessment Checklist: Alternate Energy Systems, Part 1, MEC3080–1* *Standard* *Performance rating of 3 on each criteria*	20
• describe the use of different fuels and engine designs in modern day vehicles	• a report with the following: – engine design and how it relates to fuels (other than gasoline) – alternate engine designs (other than conventional piston engine) including electric power – state advantages and disadvantages of designs. *Assessment Tool* *Task Assessment Checklist: Alternate Energy Systems, Part 2, MEC3080–1* *Standard* *Performance rating of 3 on each criteria*	40
• identify and describe future developments in fuels and engine designs	• identified opportunities for future development of alternative energy systems. *Assessment Tool* *Task Assessment Checklist: Alternate Energy Systems, Part 3, MEC3080–1* *Standard* *Performance rating of 3 on each criteria*	40

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MODULE MEC3080: ALTERNATE ENERGY SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze	• prepare and present a report detailing the origin of the first working internal combustion engine, the major advances made in the design of internal combustion engines and the manufacturing process improvements that made those innovations possible over the history of engine design • describe the development of and compare the relative efficacy of alternative contemporary design engines to the large-scale manufacture of motor vehicles • identify the rationale for change in engine design considering environmental and fuel supply issues • prepare and present a study of initiatives for using alternate fuels in engines and the factors affecting these advancements • examine and report on the present initiatives to build electric-powered cars and batteries of sufficient capacity to power them • identify which direction of alternative energy system development promises to be most successful at this time.	The engines examined might include the following: Wankel, Gas Turbine, New Concept Rotary, Kauertz Rotary Vane, Rotorcam, Split-Cycle Mighty-Mite, Bricklin Rotary Vee, Reg Technologies Rand Cam Selwood Orbital and Stirling.
Careers	• predict the opportunity for career opportunities related to emerging technological development.	

MODULE MEC3090: **COMPUTER SYSTEMS**

Level: Advanced

Theme: Guidance and Control Systems

Prerequisite: MEC2070 Emission Controls

Module Description: Students provide an overview of the applications of computer management systems used in modern vehicles.

Module Parameters: Access to computer management system diagnostic equipment and related resources.

Supporting Module: MEC2090 Electrical Components

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures related to computer management systems	• observed performance related to: – demonstrating compliance with safety and care of computer systems – care and safety in the use of tools, equipment and materials – antistatic precautions associated with the handling of a central processing unit (CPU). *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	15
• identify the principles that apply to all computer management systems	• observed performance related to: – identification of common principles shared by all computer management systems – comparisons between input devices and output devices used in vehicles and on personal computers (PCs). *Assessment Tool* *Task Assessment Checklist: Computer Systems, Part 1, MEC3090–1* *Standard* *Performance rating of 3 on each criteria*	20

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MODULE MEC3090: COMPUTER SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **locate the components of selected computer management systems and describe their function**	• observed performance related to: – location of the components of computer management systems – descriptions and location of components and their relationship to the total systems. *Assessment Tool* *Task Assessment Checklist: Computer Systems, Part 2, MEC3090–1* *Standard* *Performance rating of 3 on each criteria*	15
• **demonstrate how computer management systems operate**	• measured performance related to: – demonstrating how computer management systems obtain information, process information and make system adjustments – changing input values and predicting output values on a computer system or schematic. *Assessment Tool* *Task Assessment Checklist: Computer Systems, Part 3, MEC3090–1* *Standard* *Performance rating of 3 on each criteria*	20
• **perform diagnostic analyses of selected computer management systems and make required repairs to or replacement of malfunctioning parts**	• measured performance related to: – correct diagnosis and analysis of computer management systems – procedures for repair or replacement of parts – accuracy and skill in performing task. *Assessment Tool* *Task Assessment Checklist: Computer Systems, Part 4, MEC3090–1* *Standard* *Performance rating of 3 on each criteria*	30
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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MODULE MEC3090: COMPUTER SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow practices that promote safety for people and the environment.	Be aware of procedures that can damage CPUs.
Identification/ Function	• identify the different computer control systems that are now available on vehicles • explain the functions these computer control systems perform • state the ways in which these computer control systems replaced mechanical systems • demonstrate how selected computer control systems work compared to earlier mechanical systems • identify the principles and functions of computer control systems • locate and identify the parts of selected computer management systems • describe the function of the parts of a selected computer management system • forecast types of computer management systems that may be used on future vehicles.	
Inspect/Service	• perform diagnostic analysis of selected computer management systems • replace parts or make necessary repairs to correct malfunctioning computer management systems.	Note that faulty use of diagnostics equipment can damage the CPU.
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC3100: SAFETY SYSTEMS

Level:	Advanced
Theme:	Guidance and Control Systems
Prerequisite:	MEC2100 Power Assist Accessories
Module Description:	Students describe how safety systems can be tested, diagnosed, replaced or repaired.
Module Parameters:	Access to related resources and vehicles with safety systems. **Note:** Customer work must be checked by certified technician.

Supporting Module: MEC2090 Electrical Components

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures while working with safety systems	• observed performance related to: – appropriate use of equipment, tools and materials when working on safety systems – specific procedures used when working on safety systems such as anti-lock braking system (ABS) and air bags. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• list and compare safety systems that protect vehicle occupants	• measured performance related to: – need for the development of safety systems – research of vehicle safety systems – comparisons of types of safety systems – predicting possible future safety systems. *Assessment Tool* *Task Assessment Checklist: Safety Systems, Part 1, MEC3100–1* *Standard* *Performance rating of 3 on each criteria*	40

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MODULE MEC3100: SAFETY SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• diagnose and service vehicle safety systems	• observed performance related to: – accurate diagnosis of problems in safety systems – procedures followed to service safety systems. *Assessment Tool* *Task Assessment Checklist: Safety Systems, Part 2, MEC3100–1* *Standard* *Performance rating of 3 on each criteria*	50
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow established safety rules when working on safety systems.	Caution: SRS system. Note potential for injury from deployment of SRS systems; e.g., air bags, seat belt tensioners.
	• demonstrate the use of safety procedures and precautions necessary to avoid damage to vehicle safety systems.	Need for resources.
Investigate/Report	• describe vehicle safety systems and indicate type and dates of various systems were introduced • explain the effect various safety systems have had in reducing fatalities • identify and describe which safety systems are most effective in saving human lives, cost of manufacture and ease of use.	

MODULE MEC3100: SAFETY SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function	*The student should:* • identify safety systems in selected vehicles • list the parts of these safety systems • describe the function of these systems.	Discuss hazards associated with servicing safety systems.
Inspect/Service	• diagnose the condition and any problems found on safety systems • replace parts or make repairs to malfunctioning parts of safety systems.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC3110: **CLIMATE CONTROL**

Level: Advanced

Theme: Guidance and Control Systems

Prerequisite: MEC2030 Lubrication & Cooling

Module Description: Students expand their knowledge of the purpose, operation and servicing of standard heating and air conditioning systems.

Module Parameters: Access to air conditioning test equipment and related resources.
Note: Work must be supervised and checked by certified technician when student is working with refrigerants.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures when working with climate control systems	• observed performance related to: – safety when working on climate control systems – procedures followed when working with refrigerants – safety and care used with vehicles, equipment, tools and materials. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	15
• identify the purpose and describe the functions of heater and air conditioning system components	• measured performance related to: – identification of the parts/components – description of the function of heater and air conditioning – description of how the components combine their functions to produce hot or cold air. *Assessment Tool* *Task Assessment Checklist: Climate Control, Part 1, MEC3110–1* *Standard* *Performance rating of 3 on each criteria*	25

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MODULE MEC3110: CLIMATE CONTROL (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• perform inspection, diagnosis, service and repair procedures on heater and air conditioning systems	• observed performance related to: – inspection of climate control systems as outlined in service manuals and shop procedures – accurate diagnosis of climate control systems performance – repairs to climate control systems as outlined in manuals and procedures. *Assessment Tool* *Task Assessment Checklist: Climate Control, Part 2, MEC3110–1* *Standard* *Performance rating of 3 on each criteria*	40
• identify global concerns about the release of refrigerants into the atmosphere as well as the alternatives to standard refrigerants, and identify the required recycling procedures	• measured performance related to: – research into the effect of refrigerants on the eco-system – research into alternate refrigerants – understanding of recycling laws and procedures. *Assessment Tool* *Task Assessment Checklist: Climate Control, Part 3, MEC3110–1* *Standard* *Performance rating of 3 on each criteria*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures. • generate a list of safety concerns when working with refrigerants • outline the legal restrictions about the disposal and recycling of R–12 refrigerants • identify the safety and environmental concerns with R–12 and R–12 replacements.	Discuss legal restriction in disposal and reclaiming of R–12. Mixing refrigerants. Safety precautions when in contact with R–12 and when R–12 is in contact with open flame creating toxic gas.
Identification/ Function	• describe the operation of the heater: heat exchange, the operation of controls for fan speed, and air flow controls • identify components of an air conditioning system • describe refrigeration principles • describe air conditioning system operation.	
Identify/Analyze	• identify the causes and repair procedures for standard heater operation malfunctions; e.g., blocked or leaking heater core, temperature cable adjustment, fan motor noise, vibration and speed abnormalities • show how to conduct a visual and tactile check of operation of the refrigerant system and assess the service needs.	
Inspect/Service	• identify cause of malfunction in a climate control system and repair as required after consulting with the vehicle owner/teacher • pressure test the air conditioning refrigerant system and confirm the normalcy of system operation by comparing data with service manual • on A/C system, leak test, evacuate system, recharge, then leak test again.	In the case of equipment or facility shortage, a community partnership would be most helpful in delivering this module. Oil may need to be added.
Careers	• identify and describe the demand for skills related to climate control systems.	

MODULE MEC3120: POWER ASSISTING

Level:	Advanced
Theme:	Guidance and Control Systems
Prerequisite:	MEC2100 Power Assist Accessories
Module Description:	Students further develop their knowledge of the purpose, operation, service and repair of pneumatic, hydraulic and electric power assist devices.
Module Parameters:	Access to vacuum/pressure gauges, electrical test equipment and related resources.
Supporting Module:	MEC2120 Hydraulic Accessories

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures when working with power assists	• observed performance related to: – personal safety when working with power assist systems – safe use of equipment and tools – safety and care of vehicles, parts, equipment and materials – clean-up and workstation organization. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• identify applications of power assist components to various vehicle systems and determine the rationale for each application	• observed performance related to: – identification of power assist systems such as pressure pumps, vacuum and electric motors – identification of components of power assist systems – analysis of the purpose and rationale for using power assist systems. *Assessment Tool* *Task Assessment Checklist: Power Assisting, Part 1, MEC3120–1* *Standard* *Performance rating of 3 on each criteria*	20

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• perform service and repair procedures to pneumatic, hydraulic and electric power assist devices according to manufacturers' recommendations	• measured performance related to: – service and repair to pneumatic, hydraulic and electric components – following recommended servicing/repairing procedures – making accurate measurements. *Assessment Tool* *Task Assessment Checklist: Power Assisting, Part 2, 3, 4, MEC3120–1* *Standard* *Performance rating of 3 on each criteria*	70
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow established lab procedures.	
Identification/ Function	• describe situations in vehicle system design where power assist mechanisms are used • define the advantages of power assist over manual control and identify the type of power assist most appropriate for use in a particular situation such as steering or brakes.	
Identify/Analyze	• complete an inspection of a hydraulic power assist device using manufacturer's prescribed diagnostic procedures • estimate the repair costs for a defective or broken hydraulic assist and confer with the teacher or vehicle owner regarding the repair requirements	Consider a steering, braking system.

MODULE MEC3120: POWER ASSISTING (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze (continued)	• complete an inspection of a pneumatic assist device or system using prescribed diagnostic procedures	Vacuum assist brakes.
	• prepare an estimate of the repair requirements of a pneumatic assist and confer with the teacher or vehicle owner regarding the repair needs	Consider load levelling devices.
	• complete an inspection of an electric assist device using a prescribe diagnostic procedure	
	• prepare an estimate of the repair requirements for an electric assist device and confer with the teacher or vehicle owner regarding the required repairs.	
Inspect/Repair	• complete a repair procedure to an electric assist device or system	
	• complete a repair procedure on a hydraulic assist unit	This could be a seal, hose, pump, reservoir or valve repair.
	• complete a repair procedure on a pneumatic assist unit or system.	Repairs could include any aspect of the system or device.
Careers	• identify further education and work opportunities related to power assist devices.	

MODULE MEC3130: **AUTOMATIC TRANSMISSIONS**

Level: Advanced

Theme: Guidance and Control Systems

Prerequisite: MEC1110 Pneumatics & Hydraulics

Module Description: Students develop knowledge of automatic transmissions and transaxles, and skills in diagnosing and executing minor automatic transmission and transaxle repair requirements.

Module Parameters: Access to automatic transmission diagnostic tools, support resources.
Note: Customer work must be supervised and checked by certified technician.

Supporting Module: MEC2140 Transmissions/Transaxles

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safety and care procedures when working with automatic transmissions and transaxles	• observed performance related to: – personal safety procedures – safety and care when working with equipment, tools and materials – following safety procedures specific to automatic transmissions and transaxles – clean-up and workstation organization. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	15
• identify the parts of a torque converter and automatic transmission or transaxle, and determine the path of power and the shifting control operation in each gear setting	• observed performance related to correct: – description of parts – identification of the power flow – explanation of shift controls. *Assessment Tool* *Task Assessment Checklist: Automatic Transmissions, Part 1, MEC3130–1* *Standard* *Performance rating of 3 on each criteria*	20

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MODULE MEC3130: AUTOMATIC TRANSMISSIONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **inspect, diagnose, service and complete a minor repair to an automatic transmission and transaxle assembly**	• observed performance related to: – procedures followed during inspection, diagnosis, service and repair to automatic transmissions and transaxles – analysis of conditions that caused wear/malfunctions to automatic transmissions and/or transaxles. *Assessment Tool* *Assessment Checklist: Automatic Transmissions, Part 2, MEC3130–1* *Standard* *Performance rating of 3 on each criteria*	65
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow established lab procedures.	
Identification/ Function	• describe the operation of a torque converter • compare the internal structure of a lock-up converter and non-lock-up converter • identify the parts of a transmission assembly by naming pieces on a diagram or parts of a disassembled unit • using a hydraulic flow diagram, explain the unit engaged and shift process for each gear position	

MODULE MEC3130: AUTOMATIC TRANSMISSIONS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function (continued)	*The student should:* • interpret shifting characteristics resulting from differentiated inputs; e.g., high road speed, pulling heavy loads, throttle valve position.	
Inspect/Service	• use service manuals and road test to determine probable causes of noted conditions • complete diagnostic procedures developed from service inquiry, which may include linkage adjustments, pressure testing and further road testing as well as partial disassembly of the transmission • perform a stall test according to manufacturer's specifications • list parts for required repairs • inspect transmission/transaxle oil level and develop an assessment of its odor and colour • change transmission fluid and filter as described in the appropriate service manual • check unit for oil leakage and determine a cause for loss of oil • repair a fluid leak • evaluate the condition and adjustment of linkage • locate and correct a transmission linkage or band adjustment where required • remove, clean and reinstall a transmission valve body assembly.	For example, oil pan and/or valve body removal. Cost estimate including labour may be done.
Inspect/Repair	• remove and repair or replace an automatic transmission assembly.	May require Career Transitions module to replace/repair a transmission on a customer vehicle.
Careers	• identify further education and work opportunities related to automatic transmissions.	

MODULE MEC3140: DRIVE TRAIN REPAIR

Level: Advanced

Theme: Guidance and Control Systems

Prerequisite: MEC2130 Drive Trains

Module Description: Students perform overhauls on clutch, transmission and differential assemblies.

Module Parameters: Access to specialized drive train tools, drive train units and related resources.

Supporting Module: MEC2140 Transmissions/Transaxles

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safe work practices, and follow established lab procedures	• observed performance related to: – safe practices when servicing/repairing drive train components. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• replace a clutch assembly	• measured performance related to clutch: – following shop procedures – following procedures in shop manuals – accuracy and quality of clutch repairs/replacement work. *Assessment Tool* *Task Assessment Checklist: Drive Train Repair, Part 1, MEC3140–1* *Standard* *Performance rating of 3 on each criteria*	15
• remove, overhaul and replace a manual transmission/transaxle	• observed performance related to: – following shop procedures – following procedures in shop manuals – accuracy and quality of transmission repairs/replacement work. *Assessment Tool* *Task Assessment Checklist: Drive Train Repair, Part 2, MEC3140–1* *Standard* *Performance rating of 3 on each criteria*	35

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MODULE MEC3140: DRIVE TRAIN REPAIR (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **measure and adjust a differential assembly**	• observed performance related to: – finding and following manufacturer's specifications – accurate measurements – accurate adjustments to differentials – information retrieval. *Assessment Tool* *Task Assessment Checklist: Drive Train Repair, Part 3, MEC3140–1* *Standard* *Performance rating of 3 on each criteria*	15
• **overhaul a drive axle assembly**	• measured performance related to drive axles: – following shop procedures – accurate removal and overhaul of parts including constant velocity (CV) joints. *Assessment Tool* *Task Assessment Checklist: Drive Train Repair, Part 4, MEC3140–1* *Standard* *Performance rating of 3 on each criteria*	25
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow established lab procedures.	Refer to asbestos hazards.

MODULE MEC3140: DRIVE TRAIN REPAIR (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function	*The student should:* • explain the operation and power flow in various transmissions and transaxles • describe drive axle operation and components of four-wheel, front-wheel and rear-wheel drive vehicles • describe types of differential assemblies and explain operation of the following: – full floating – semi-floating – hunting – non-hunting • describe the operation of a limited slip differential assembly.	
Inspect/Service and Repair	• remove and replace a clutch assembly • identify the serviceability of each part • adjust linkage to specified clearance • remove and replace specified transmission and overhaul to manufacturer's specifications • overhaul constant velocity joints • measure and adjust a differential assembly.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC3150: WHEEL ALIGNMENT

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC2150 Suspension Systems

Module Description: Students develop the knowledge, skills and attitudes necessary for repairing and aligning various vehicle steering systems.

Module Parameters: Access to wheel alignment equipment and supporting resources.
Note: Customer work must be supervised and checked by a certified technician.

Supporting Module: MEC2160 Steering Systems

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **follow established safe work procedures**	• observed performance related to personal safety and vehicle care. *Assessment Tool* *Assessment Checklist: Health and Safety, MECH&S* *Standard* *Performance rating of 3 on each criteria*	10
• **investigate and determine the condition of various components that affect wheel alignment and tracking**	• measured performance related to pre-alignment: – determining the condition of steering components – determining the condition of suspension components – applying recommended procedures and practices. *Assessment Tool* *Task Assessment Checklist: Wheel Alignment, Part 1, MEC3150–1* *Standard* *Performance rating of 3 on each criteria*	25

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MODULE MEC3150: WHEEL ALIGNMENT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
• **identify measurements and angles used to check and adjust suspension and steering systems**	• observed performance related to: – identifying and measuring angles – identifying methods of angle adjustments – indicating effects of incorrect angles on vehicle handling and component life. *Assessment Tool* *Task Assessment Checklist: Wheel Alignment, Part 2, MEC3150–1* *Illustrative Example: Wheel Alignment, MEC3150–2* *Standard* *Performance rating of 3 on each criteria*	25
• **use specialized alignment equipment to check and adjust alignment angles on various suspension types to manufacturers' specifications**	• observed performance related to: – information retrieval – accurate measurements – correct use of special tools/equipment – correct alignment adjustments. *Assessment Tool* *Task Assessment Checklist: Wheel Alignment, Part 3, MEC3150–1* *Standard* *Performance rating of 3 on each criteria*	30
• **use road test information to determine the quality of service work performed**	• observed performance related to: – assessment of the work done – analysis of driving symptoms – report on vehicle status to customer. *Assessment Tool* *Task Assessment Checklist: Wheel Alignment, Part 4, MEC3150–1* *Illustrative Example: Wheel Alignment, MEC3150-2* *Standard* *Performance rating of 3 on each criteria*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures.	
Identification/ Function	• define and explain camber, caster, toe, steering axis inclination, toe-out on turns and tracking.	
Identify/Analyze	• solve common steering and suspension problems such as: – loose steering – hard steering – vehicle wander – pulling to one side – wheel shimmy – wheel tramp – improper tire wear.	
Inspect/Service	• demonstrate how to: – check and correct tire pressures and determine reason for abnormal tire wear – check and adjust wheel bearings – check and adjust wheel/tire run out – check and correct tire balance – check and correct steering linkage problems – check and adjust steering gear – check and correct shock absorber problems – check and correct riding height – check vehicle tracking – check alignment angles for a given vehicle using the appropriate alignment equipment – adjust alignment angles to manufacturer's specifications on at least two different suspension types	
Careers	• identify further education and work opportunities related to wheel alignment.	

MODULE MEC3160: BODY REPAIR ESTIMATION

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC1160 Structures & Materials

Module Description: Students apply knowledge in estimating, including close attention to detail in determining the cost of a repair.

Module Parameters: Access to supporting resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• state the role of insurance in the body repair industry and legal obligations involved in estimating	• explanation of four of the following terms: – insurance – liability – waiver – write-off – premium/deductible. *Assessment Tool* *Task Assessment Checklist: Body Repair Estimation, Part 1, MEC3160–1* *Standard* *Performance rating of 3 on each criteria*	10
• identify and describe types of body damage	• presentation of a report that defines/determines: – collision damage (direct) – hidden damage – accessory parts – parts sources and prices (original equipment manufacturer versus aftermarket) – damage owing to collision. *Assessment Tool* *Task Assessment Checklist: Body Repair Estimation, Part 2, MEC3160–1* *Standard* *Performance rating of 3 on each criteria*	20

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MODULE MEC3160: BODY REPAIR ESTIMATION (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• outline skills needed to successfully estimate collision damage	• identification of skills required for estimating collision damage, including: – visual analysis of frame and body damage – part identification and location – accurate calculation of costs including time required and supplies. *Assessment Tool* *Task Assessment Checklist: Body Repair Estimation, Part 3, MEC3160–1* *Standard* *Performance rating of 3 on each criteria*	25
• complete an estimate by determining what parts/components are to be replaced or repaired and their subsequent costs	• demonstration of estimating skills including: – problem-solving ability in determining cost of repair – knowledge of vehicle value versus repair cost – estimate of repair including parts, labour costs, shop costs, miscellaneous costs according to industrial standards. *Assessment Tool* *Task Assessment Checklist: Body Repair Estimation, Part 4, MEC3160–1* *Illustrative Example: Body Repair Estimation, MEC3160–2* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

MODULE MEC3160: BODY REPAIR ESTIMATION (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures. • identify mechanical and electrical components often damaged in collision, and state appropriate safety precautions in dealing with gasoline, oil, air conditioning gas and battery acid hazards.	
Identify/Analyze	• list and describe the terms used in the appraisal industry • describe vehicle construction systems (unibody and framed) and safety requirements • examine the effects of collision on vehicle structure, parts and passenger safety equipment • demonstrate the effects of forces on metal and show how manufacturing techniques are used to absorb collision energy • define the terms primary damage, secondary damage and hidden damage • identify related damaged parts • investigate and describe collision damage to: – determine direction of damage – identify parts damaged (including hidden damage) – list signs of hidden damage • conduct tests to determine mechanical and/or electrical functions in order to properly estimate cost of collision damage • estimate cost including parts, labour and miscellaneous • calculate the cost of original equipment (OEM), aftermarket and used parts that could be used in a repair • complete a replacement parts list for a given collision, including "cost," "extended cost" and "contracted" costs	

MODULE MEC3160: BODY REPAIR ESTIMATION (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • list examples of hidden and "other" costs that must be included in an estimate of collision damage • describe the responsibility of the shop to the customer, the insurer and legal parties in doing an estimate; e.g., safety of vehicle • define write-off and explain when a vehicle is considered a write-off and non-repairable • explain the advantages of having a knowledge of vehicle structure and repair procedures when completing an estimate for repair.	
Careers	• identify further education and work opportunities related to body repair estimation.	

MODULE MEC3170: DAMAGE ANALYSIS

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC2170 Metal Repair & Finishing

Module Description: Students identify and examine physical damage caused by collisions, and learn cost estimating procedures.

Module Parameters: Access to damaged vehicle, measuring gauges and related resources.

Supporting Modules: 2150 Suspension Systems
2160 Steering Systems

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safe work procedures	• observed performance related to: – safe positioning of vehicle jacks and jack stands – following shop routines in removal of parts. *Assessment Tool* *Task Assessment Checklist: Damage Analysis, Part 1, MEC3170–1* *Standard* *Performance rating of 3 on each criteria*	10
• identify types and signs of collision damage	• presentation of a report describing: – vehicle construction and safety features preventing collision damage – frame types and related damage – signs of secondary and hidden damage – methods used to determine damage. *Assessment Tool* *Task Assessment Checklist: Damage Analysis, Part 2, MEC3170–1* *Standard* *Performance rating of 3 on each criteria*	15

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MODULE MEC3170: DAMAGE ANALYSIS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• examine and use measurements to determine extent of vehicle damage	• calculate measurements to show: – direction and extent of damage – possible suspension problems through direct and indirect damage to a vehicle. *Assessment Tool* *Task Assessment Checklist: Damage Analysis, Part 3, MEC3170–1* *Standard* *Performance rating of 3 on each criteria*	30
• prepare a repair strategy for a given vehicle	• demonstration of: – problem-solving ability in determining cost of repair – knowledge of vehicle value versus repair costs – industry standards of repair including parts, labour and shop cost estimates. *Assessment Tool* *Task Assessment Checklist: Damage Analysis, Part 4, MEC3170–1* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow established lab procedures.	

MODULE MEC3170: DAMAGE ANALYSIS (continued)

Concept	Specific Learner Expectations	Notes
Identification/ Function	*The student should:* • describe manufacturer's methods used in vehicle construction and define the terms used to identify vehicle body parts • describe methods used in vehicle construction to control damage through energy transfer and differences in structural strength • identify the specific occupant safety features built into the vehicle as required by law or provided as a vehicle option.	
Inspect/Report	• demonstrate basic principles of estimating damage repair and apply to a specific situation • estimate repair or replacement of safety equipment damaged in a collision • identify the basic frame structures used in auto construction, and describe the measurement charts used to determine misalignment • calculate frame alignment measurements to determine extent of misalignment and explain the results of the measurements • use frame gauges and charts • analyze measurements and determine repair procedure • explain the value of using used, after market or OEM parts in any given repair • complete a damage analysis for a given vehicle • prepare strategy plan showing correct repair sequence.	ABS, air bag, suspension and personal restraint systems.
Careers	• identify further education and work opportunities related to structural damage analysis.	

MODULE MEC3180: DAMAGE REPAIR 1

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC2170 Metal Repair & Finishing

Module Description: Students examine the methods used to complete a repair involving removing, replacing and aligning of body parts.

Module Parameters: Access to specialized body tools, hand tools and related resources.
Note: The student must have access to instruction from an individual with journeyman qualifications if students are involved in customer work.

Supporting Module: MEC3170 Damage Analysis

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **demonstrate established safety procedures**	• observed performance related to the safe handling and use of tools and equipment. *Assessment Tool* *Task Assessment Checklist: Damage Repair 1, Part 1, MEC3180–1* *Standard* *Performance rating of 3 on each criteria*	10
• **follow an approved sequence of repairs involving removing and replacing damaged external parts**	• observed performance in: – organizing work and work-site – analyzing correct repair sequence – removal of parts and accessories required. *Assessment Tool* *Task Assessment Checklist: Damage Repair 1, Part 2, MEC3180–1* *Standard* *Performance rating of 3 on each criteria*	25

MODULE MEC3180: DAMAGE REPAIR 1 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **align parts used to repair and prepare components for painting or priming**	• observed performance related to the ability to: – repair parts that can be repaired – replace parts and correctly align showing knowledge of alignment principles. *Assessment Tool* *Task Assessment Checklist: Damage Repair 1, Part 3, MEC3180–1* *Standard* *Performance rating of 3 on each criteria*	40
• **remove, repair or replace trim parts as required**	• observed performance in: – using problem-solving skill to assess and repair damage – listing parts and/or repairs required – estimating cost of repair and making cost effective decision – replacing or repairing trim. *Assessment Tool* *Task Assessment Checklist: Damage Repair 1, Part 4, MEC3180–1* *Standard* *Performance rating of 3 on each criteria*	25
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tools* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of and follow established lab procedures • demonstrate approved safety procedures in the use of jacks, jack stands, impact wrenches, torches, plasma arc and abrasive cutters to remove or replace parts	Consideration must be given to techniques that prevent damage to adjacent surfaces or parts.

MODULE MEC3180: DAMAGE REPAIR 1 (continued)

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards (continued)	*The student should:* • demonstrate knowledge, skills and attitudes in the safe use of hand tools.	
Inspect/Report	• examine damage to external parts and identify appropriate repair sequence • complete a list of required parts and show cost-effectiveness of using aftermarket or used parts • list methods used in the manufacture of vehicles to align adjacent parts, including shims, slotted holes and bending • examine the bumper shock system and explain the effects of collision to "bumper shocks" and their alignment • describe the importance of correct alignment of body parts and the effects of "misalignment," both aesthetically and physically • explain the function of trim • identify methods of trim fastening.	
Inspect/Repair	• successfully remove trim and damaged parts, showing knowledge of tools and care for property • demonstrate knowledge and skill in the preparation of existing flanges, edges and mounting points used for replacement of new parts • safely remove and replace a door, hood and/or trunk lid • replace and align a fender • install new or original trim and recognize the value of using OEM trim parts.	
Careers	• identify further education and work opportunities related to structural damage repair.	

MODULE MEC3190: DAMAGE REPAIR 2

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC3180 Damage Repair 1

Module Description: Students examine methods used to complete a collision repair involving unibody parts replacement and frame correction.

Module Parameters: Access to hydraulic push/pull equipment, GMAW and cutting equipment, basic body tools and related resources.

Note: The students must have access to instruction from an individual with journeyman qualifications if they are involved in customer work.

Supporting Modules:
MEC2150 Suspension Systems
MEC2160 Steering Systems
MEC2170 Metal Repair Finishing
MEC2190 Surface Preparation

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate established safe work procedures	• observed performance related to the safe handling of vehicles in repair using GMAW and oxy-acetylene equipment *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 1, MEC3190–1* *Standard* *Performance rating of 3 on each criteria*	10
• describe construction features and materials used in vehicle bodies and methods of repair	• presentation of a report describing vehicle construction, showing knowledge of: – high strength steel (HSS)/high strength low alloy (HSLA) metals – unibody construction – frame construction – methods used to repair vehicle bodies. *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 2, MEC3190–1* *Standard* *Performance rating of 3 on each criteria*	10

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MODULE MEC3190: DAMAGE REPAIR 2 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• use a "bench" frame straightening system and related measurements to straighten/align a component	• observed performance in using "frame" equipment, including knowledge of "measurement" charts and parts terminology. *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 3, MEC3190–1* *Standard* *Performance rating of 3 on each criteria*	15
• identify misalignment of frame and suspension parts and components	• observed performance given a damaged vehicle, demonstrating: – problem solving/analyzing existing misalignment – selecting resources to assist in repair analysis – understanding of suspension geometry. *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 4, MEC3190–1* *Standard* *Performance rating of 3 on each criteria*	25
• correct frame/body alignment involving replacement of unibody panels and use of hydraulic jacks and welders	• observed performance related to: – use of hydraulic push/pull equipment – unibody panel replacement – welding and cutting tool use – alignment and fabrication of damaged parts. *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 5, MEC3190–1* *Illustrative Example: Damage Repair 2, MEC3190–2* *Standard* *Performance rating of 3 on each criteria*	25
• explain the importance of proper frame and suspension alignment, including legal implications	• ability to identify suspension parts and problems incurred by misalignment owing to collision. *Assessment Tool* *Task Assessment Checklist: Damage Repair 2, Part 6, MEC3190–1* *Standard* *Performance rating of 3 on each criteria*	15

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MODULE MEC3190: DAMAGE REPAIR 2 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow lab safety procedures. • demonstrate safety procedures required in the use of hydraulic jacks, GMAW welding and oxy-acetylene and/or plasma arc cutting equipment • list the safety implications of collision damage causing suspension misalignment, including legal implications.	
Identification/ Function	• identify and describe three kinds of frame structures, giving the advantages and applications of each • define the terms HSS and HSLA, and explain the need for these metals in unibody construction • describe the "bench system" used by professional auto repair shops in unibody collision repair • describe and use measurements and measurement charts to determine the degree of misalignment • define the terms twist, sag, sway and diamond • describe measurements that will indicate each of the above conditions.	

MODULE MEC3190: DAMAGE REPAIR 2 (continued)

Concept	Specific Learner Expectations	Notes
Identify/Analyze	*The student should:* • describe the correct procedure used to repair a unibody frame that shows misalignment • demonstrate how to use hydraulic jacking systems in the repair of collision damage • identify three kinds of suspension systems used by auto makers • define the terms toe-in, camber and castor, and explain how each affects car tracking and drive ability.	
Inspect/Repair	• use a bench (or equivalent) frame-straightening system to correct alignment • align and fabricate damaged parts.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC3200: **REFINISHING 2**

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC2200 Refinishing 1

Module Description: Students demonstrate finishing skills and techniques related to the preparation and application of metallic paints.

Module Parameters: Access to spray equipment and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices and follow all warnings identified by product manufacturers, Workplace Hazardous Materials Information System (WHMIS), and Occupational Health and Safety	• observed performance related to: – health hazards involved in refinishing – adherence to warnings as outlined in WHMIS bulletins – following proper personal and shop safety routines. *Assessment Tool* *Task Assessment Checklist: Refinishing 2, Part 1, MEC3200–1* *Standard* *Performance rating of 3 on each criteria*	15
• describe top coats, solvents and additives used in surface finishes	• presentation of a report identifying and describing: – top coats – solvents – additives. *Assessment Tool* *Task Assessment Checklist: Refinishing 2, Part 2, MEC3200–1* *Standard* *Performance rating of 3 on each criteria*	20

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MODULE MEC3200: REFINISHING 2 (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **apply metallic, tutone and/or base/clear coat and acrylic enamel finishes**	• observed performance related to: – proper use of paint products – following specific procedures in the application of acrylic enamels and base/clear coat systems. *Assessment Tool* *Task Assessment Checklist: Refinishing 2, Part 3, MEC3200–1* *Standard* *Performance rating of 3 on each criteria*	55
• **apply problem-solving techniques to paint and equipment problems**	• observed performance related to solving spray problems related to application methods and equipment malfunction. *Assessment Tool* *Task Assessment Checklist: Refinishing 2, Part 4, MEC3200–1* *Standard* *Performance rating of 3 on each criteria*	10
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal exploration during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Safety and Environmental Concerns	• demonstrate knowledge of health hazards and environmental impacts of products used • demonstrate use of personal protective equipment as recommended by manufacturer.	WHMIS; product information. MSDS Sheets available. Respirators; gloves, coveralls.
Identify/Analyze	• identify three types of top coats and describe characteristics showing similarities and differences	

Concept	Specific Learner Expectations	Notes
Identify/Analyze (continued)	*The student should:* • demonstrate and explain correct procedures in preparing top coats for application including correct selection of solvents and additives • identify and select colour and type of paint for a given vehicle identification plates and code books • identify differences in spray gun types and uses • describe refinishing equipment accessories.	
Inspect/Repair	• select, mix and apply two or more of the following finishes: – acrylic enamel – metallic – tutone – base/clear coat • complete a vehicle re-coat • solve paint and equipment problems observed during application.	
Careers	• identify further education, working conditions and career opportunities.	

MODULE MEC3210: PLASTIC & FIBREGLASS

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC1160 Structures & Materials

Module Description: Students determine the types of plastic and fibreglass materials required for repairs, and perform appropriate repair procedures.

Module Parameters: Access to plastic welding equipment and related materials and resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify hazards and safety precautions to be observed when working with plastics	• observed performance related to: – use of plastic repair materials – personal safety requirements – following established shop procedures. *Assessment Tool* *Task Assessment Checklist: Plastic & Fibreglass, Part 1, MEC3210–1* *Standard* *Performance rating of 3 on each criteria*	10
• describe types of plastics, welding equipment and bonding processes used to repair plastics parts	• preparation of a chart or other visual presentation indicating: – plastic types – repairability – materials required for repair. *Assessment Tool* *Task Assessment Checklist: Plastic & Fibreglass, Part 2, MEC3210–1* *Standard* *Performance rating of 3 on each criteria*	15
• apply plastic welding and/or bonding techniques to repair a plastic component	• observed performance in completion of a plastic repair. *Assessment Tool* *Task Assessment Checklist: Plastic & Fibreglass, Part 3, MEC3210–1* *Standard* *Performance rating of 3 on each criteria*	30

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MODULE MEC3210: PLASTIC & FIBREGLASS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• identify types of fibreglass materials and repair procedures	• ability to identify three kinds of fibreglass material, related resins/hardeners and repair procedures. *Assessment Tool* *Task Assessment Checklist: Plastic & Fibreglass, Part 4, MEC3210–1* *Standard* *Performance rating of 3 on each criteria*	10
• perform a fibreglass repair on a component	• observed performance in the completion of a repair: – using safe handling techniques – using proper preparation of repair area – using correct application of material – following approved finishing steps. *Assessment Tool* *Task Assessment Checklist: Plastic & Fibreglass, Part 5, MEC3210–1* *Standard* *Performance rating of 3 on each criteria*	35
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health/Safety Hazards	*The student should:* • demonstrate knowledge of and follow accepted safety practices when working with hot liquids, plastic solvents, resins and equipment.	Consider WHMIS regulations and ventilation requirements.

MODULE MEC3210: PLASTIC & FIBREGLASS (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identify/Analyze	• identify and state characteristics of plastics used in vehicle manufacture • identify plastics that can be repaired by welding and bonding • explain the types of plastic welding equipment available and when this repair process should be used • identify welding rods • explain which bonding agents are available and their application • identify type of plastic, and decide whether to weld or bond • state why a particular process was chosen.	CAUTION: Bonding agents can be very toxic. Follow **all** the manufacturer's safety requirements.
Inspect/Repair	• identify correct layout • prepare "witness lines" for repeat layout • prepare/clean plastic material as per instructions for process used • create a solid lay-up • weld/bond materials • prepare damaged area • prepare material • apply material.	Bonding processes are becoming more prevalent than welding.
Careers	• describe how prevalent plastic repairs are in industry.	

MODULE MEC3220: GLASS REPLACEMENT

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC2180 Trim Replacement

Module Description: Students demonstrate knowledge, skills and practice related to vehicle glass installation and adjustment.

Module Parameters: Access to glass removal tools, related materials/resources and glazed vehicles.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• handle glass and related materials safely	• observed performance related to: – clean-up/disposal of damaged glass – safety procedures required – proper handling and installation of materials. *Assessment Tool* *Task Assessment Checklist: Glass Replacement, Part 1, MEC3220–1* *Standard* *Performance rating of 3 on each criteria*	10
• identify glass types and glass retaining systems	• presentation of a report describing: – glass retaining systems – moldings and seals – glass types and their functions. *Assessment Tool* *Task Assessment Checklist: Glass Replacement, Part 2, MEC3220–1* *Standard* *Performance rating of 3 on each criteria*	15
• demonstrate knowledge of tools and procedures used by glass technicians	• observed performance related: – identification and use of tools – following instructions as given by specific manufacturer's manuals – proper installation and testing procedures. *Assessment Tool* *Task Assessment Checklist: Glass Replacement, Part 3, MEC3220–1* *Standard* *Performance rating of 3 on each criteria*	20

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• **complete glass removal installations and adjustments**	• observed performance in completion of: – front or rear glass removal/replacement – side glass removal/installation adjustment – sealing and testing installation performed. *Assessment Tool* *Task Assessment Checklist: Glass Replacement, Part 4, MEC3220–1* *Standard* *Performance rating of 3 on each criteria*	55
• **demonstrate basic competencies.**	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• identify safety concerns when working with glass • show knowledge of safety procedures needed in glass removal • identify installation product safety concerns in the glass industry.	
Identification/ Function	• identify types of glass and retaining systems used in auto industry • outline the removal procedures required for two different systems • show knowledge of trim parts used around glass • identify molding retainers, glass seal products and procedures for installation • identify door glass adjustment methods.	

Concept	Specific Learner Expectations	Notes
Inspect/Repair	*The student should:* • remove front or rear glass following safety guidelines • install several glass systems, including door glass and side lights • adjust door glass on several different systems.	Refer to manufacturer's specifications for front and rear glass installations to provide vehicle integrity.
Careers	• identify further education and work opportunities related to vehicle glass removal and installation.	

MODULE MEC3230: **REFINISHING 3**

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisite: MEC3200 Refinishing 2

Module Description: Students demonstrate knowledge and skills of advanced finishing techniques, including custom painting, mixing, tinting, colour and texture matching.

Module Parameters: Access to spray equipment, surface repair equipment and related resources.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• demonstrate safe work practices, and follow all product warnings and labels identified by the product manufacturers, Workplace Hazardous Materials Information System (WHMIS) and Occupational Health and Safety	• observed performance related to: – safe handling of chemicals and paint products – knowledge of potential dangers with improper use of products – proper use of resources (WHMIS/MSDS) – following shop routines for painting. *Assessment Tool* *Task Assessment Checklist: Refinishing 3, Part 1, MEC3230–1* *Standard* *Performance rating of 3 on each criteria*	15
• investigate and describe advanced products, techniques and equipment used to achieve an acceptable original equipment manufacturer finish	• presentation of a report demonstrating knowledge of: – plastic coatings – colour matching using colour-code references – tinting systems for mixing procedures. *Assessment Tool* *Task Assessment Checklist: Refinishing 3, Part 2, MEC3230–1* *Standard* *Performance rating of 3 on each criteria*	25

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Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • apply an advanced level finish	*Assessment of student achievement should be based on:* • observed performance in application of refinished products for special requirements: – tutone – striped – custom. *Assessment Tool* *Task Assessment Checklist: Refinishing 3, Part 3, MEC3230–1* *Standard* *Performance rating of 3 on each criteria*	60
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Health/Safety Hazards	• demonstrate knowledge of health hazards and environmental impacts of products used • demonstrate knowledge of special procedures in the preparation of plastic and vinyl parts.	Supplier recommendations.
Identification/ Function	• explain alternate spray equipment	Airless spray gun, electro static, air brushes, touch-up gun.
	• describe types and use of spray booths	Type, maintenance.
	• explain compressors, drying systems	
	• identify styles and techniques of custom painting	
	• explain mixing and tinting systems	Tour body shop and/or post-secondary institute.

MODULE MEC3230: REFINISHING 3 (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Identification/ Function (continued)	- analyze colour/texture and identify the following: – lightness/darkness – cast – brightness	
	- describe how colours are matched	Matching colours and metallics.
	- explain how to create a textured finishes	Rock guard, spatter finishes.
	- describe various paint mixing/tinting procedures.	
Inspect/Repair	- demonstrate advanced top coat application techniques	Application consistency, improved gun control.
	- identify styles and techniques of custom painting	CAUTION: Use only recommended cleaners on plastics and urethanes.
	- apply a custom paint job	
	- perform advanced troubleshooting of application/equipment problems	
	- demonstrate proper selection and application of colour coats for plastic and vinyls.	Bumper paint, vinyl roofs.
Careers	- identify further education, working conditions and career opportunities.	

MECHANICS

SECTION G: ASSESSMENT TOOLS

The following pages comprise background information and strategies for assessing student achievement and the assessment tools that are listed in Sections D, E and F of this Guide.

This section of the Guide to Standards and Implementation has been designed to provide a common base of understanding about the level of competencies students are expected to demonstrate to successfully complete a module. The goal is to establish assessment standards for junior and senior high school students that are fair, credible and challenging.

These tools will assist teachers throughout the province to more consistently assess student achievement. The purpose of expanding on the assessment standards is to:

- increase confidence among students, parents, business/ industry and post-secondary that students can demonstrate the competencies specified in the modules they have completed
- encourage fairness and equity in how students' efforts are judged
- enable learners to focus effort on key learnings
- support teachers and community partners in planning and implementing CTS.

These tools were validated during the optional stage of CTS implementation.

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ASSESSING STUDENT ACHIEVEMENT IN CTS

The CTS assessment standards assess two basic forms of competency:

- What can a student ***do***?
  - **make** a product (e.g., wood bowl, report, garment)
  - **demonstrate** a process
    - strand-related competencies (e.g., keyboarding, hair cutting, sewing techniques, lab procedures)
    - basic competencies (e.g., resource use, safety procedures, teamwork).

- What does a student ***know***?
  - knowledge base needed to demonstrate a competency (link theory and practice).

CTS Defines *Summative* Assessment Standards

The assessment standards and tools defined for the CTS modules, referenced in Sections D, E and F of this Guide, focus on the final (or summative) assessment of student achievement.

Assessment throughout the learning period (formative assessment) will continue to evaluate how students are progressing. Teachers direct and respond to students' efforts to learn—setting and marking tasks and assignments, indicating where improvement is needed, sending out interim reports, congratulating excellence, etc.

Teachers will decide which instructional and assessment strategies to apply during the formative learning period. As formative and summative assessment are closely linked, some teachers may wish to modify the tools included in this section to use during the instructional process. Teachers may also develop their own summative assessment tools as long as the standards are consistent with the minimum expectations outlined by Alberta Education.

Grading and Reporting Student Achievement

When a student can demonstrate ALL of the exit-level competencies defined for the module (module learner expectations), the teacher will designate the module as "successfully completed." The teacher will then use accepted grading practices to determine the percentage grade to be given for the module—a mark not less than 50%.

The time frame a teacher allows a student to develop the exit-level competency is a local decision. NOTE: The Senior High School Handbook specifies that students must have access to 25 hours of instruction for each credit. Students may, however, attain the required competencies in less time and may proceed to other modules.

Teachers are encouraged to consult their colleagues to ensure grading practices are as consistent as possible.

High school teachers may wish to refer to "Directions for Reporting Student Achievement in CTS" for information on how to use the CTS course codes to report the credits that students have earned to Alberta Education. (Copies of this document have been forwarded to superintendents and senior high school principals.)

Components of Assessment Standards in CTS

The following components are included in each module:

- **module learner expectations** (in the shaded left column of the module) define the exit-level competencies students are expected to achieve to complete a module. Each MLE defines and describes critical behaviours that can be measured and observed. The student must meet the standard specified for **ALL** MLEs within a module to be successful.

- **suggested emphasis** (in the right column of the module) provides a guideline for the relative significance of each MLE and can be used to organize for instruction.

- **criteria and conditions** (in the middle column of the module) set the framework for the assessment of student competency, specifying the minimum standard for performance and including a reference to assessment tools, where appropriate.

  Criteria define the behaviours that a student must demonstrate to meet the designated standard. For example, the criteria could describe the various techniques that must be demonstrated when using a tool, and/or describe the minimum components of a project the student must complete.

  Conditions outline the specifications under which a student's competency can be judged. For example, the conditions could specify whether the assessment should be timed or not, or if the student should be allowed to access to support resources or references.

  Standard may be defined by (1) assessment tools, which are referenced in this section (or sometimes in approved learning resources) and/or (2) "illustrative examples" of student work, if appropriate.

  Assessment Tools included in this section of the Guide tend to be of two types:

  - tools generic to a strand or to the entire CTS program; e.g., a standard five-point rating scale is used in all strands. Other generic tools include assessing reports and presentations and lab safety checklists. *(Names of these tools include the strand code [e.g., "INF" for Information Processing] and a code for the type of tool [e.g., "TDENT" for Text-Data Entry].)*
  - tools specific to a module; e.g., assessment checklist for assessing a venture plan in Enterprise and Innovation or a checklist for sketching, drawing and modelling in Design Studies. *(Names of these tools include the module code; e.g., "INF1010–1" indicating that it is the first module-specific tool used in Information Processing Module 1010.)*

Development and Validation Processes

The "Criteria and Conditions" and "Suggested Emphasis" columns were validated with extensive input from teachers, professional associations/ contacts and post-secondary institutions. The goal was to prepare well-structured assessment standards and related assessment tools that:

- establish an appropriate level of challenge and rigour
- relate directly to the type of learning described in the curriculum standard
- are easy to understand
- are efficient to implement
- can provide a consistent measure of what was expected to be measured.

As students and teachers work with the assessment standards and tools, it is expected that levels of performance will increase as more and more students are able to achieve the minimum standard. Therefore, the assessment standards and related tools will continue to be monitored, and revised as necessary to ensure appropriate levels of rigour and challenge, and successful transitions for students as they leave high school and enter the workplace or related post-secondary programs.

ASSESSING STUDENT ACHIEVEMENT IN MECHANICS

The Mechanics curriculum supports the principles of results-based curriculum in the way curriculum is structured, the type and range of learnings afforded to students and the manner in which they can be measured or assessed. Each modules identifies criteria and conditions for each module learner expectation with a suggested emphasis within that particular module. These aspects provide for a framework for student learning and assessment with a great deal of consistency.

Assessment Strategies and Tools

In the following section, a number of different tools are provided for Mechanics facilitators, either as a reference or applied for specific assessment purposes. The intent is to provide guidance to teachers in assessing student work with a standard that is fair to students and also will be recognized by stakeholder groups as valid. This will provide students with linkages to further learnings or the workplace.

In CTS, assessment tools are intended to be used for summative assessment, assessment when student has completed requirements for particular module learner expectations. Teachers will still be required to assess throughout the learning period (formative assessment) and tools can be modified to accomplish this end or new tools developed. Teachers can best gauge which instructional and assessment strategies to apply during the formative learning period.

Tools Generic to Mechanics

Generic tools have been developed for basic competencies, laboratory practice and presentations/reports, customer service and career exploration. It is intended that the basic competencies are integrated throughout the program whereas customer service and career exploration are applied as assessment strategies dictate. The laboratory practice tools will provide specific assessment in laboratory related learning and will assist in showing competency progression from introductory to advanced levels. Presentations/reports assessment tools are applied to theoretical components of the curriculum and provide consistency in assessing those aspects but not necessarily dictating a particular process.

Tools Specific to Mechanics

Tools have also been developed to assess specific MLEs in a module and are labelled with the module number and tools number; e.g., MEC1010–1. They are referred to under the criteria and conditions for each module.

These assessment tools outline the criteria for assessment and provide the minimum standard to which the student must perform tasks or processes. It should be noted that a scale of 1–4 is utilized and generally, the following minimum standards apply: introductory level = 1, intermediate level = 2, and advanced level = 3.

Suggested Emphasis for Assessment

The "Suggested Emphasis" column provides a guideline for the relative significance of each MLE to assist in organizing for instruction. The basic competencies are expected to be integrated throughout and therefore the tools have been designed to assess the relevant basic competencies and the product, process and/or theory. The exception to this would be when a test bank is being used. In this case it is recommended that basic competencies be assessed separately.

BASIC COMPETENCIES REFERENCE GUIDE

The chart below outlines basic competencies that students endeavour to develop and enhance in each of the CTS strands and modules. Students' basic competencies should be assessed through observations involving the student, teacher(s), peers and others as they complete the requirements for each module. In general, there is a progression of task complexity and student initiative as outlined in the Developmental Framework*. **As students progress through Stages 1, 2, 3 and 4 of this reference guide, they build on the competencies gained in earlier stages**. Students leaving high school should set themselves a goal of being able to demonstrate Stage 3 performance.

Suggested strategies for classroom use include:

- having students rate themselves and each other
- using in reflective conversation between teacher and student
- highlighting areas of strength
- tracking growth in various CTS strands
- highlighting areas upon which to focus
- maintaining a student portfolio.

Stage 1— *The student:*	**Stage 2—** *The student:*	**Stage 3—** *The student:*	**Stage 4—** *The student:*
Managing Learning			
☐ comes to class prepared for learning	☐ →	☐ →	☐ →
☐ follows basic instructions, as directed	☐ follows instructions, with limited direction	☐ follows detailed instructions on an independent basis	☐ →
	☐ sets goals and establishes steps to achieve them, with direction	☐ sets clear goals and establishes steps to achieve them	☐ demonstrates self-direction in learning, goal setting and goal achievement
☐ acquires specialized knowledge, skills and attitudes	☐ applies specialized knowledge, skills and attitudes in practical situations	☐ transfers and applies specialized knowledge, skills and attitudes in a variety of situations	☐ transfers and applies learning in new situations; demonstrates commitment to lifelong learning
☐ identifies criteria for evaluating choices and making decisions	☐ identifies and applies a range of effective strategies for solving problems and making decisions	☐ uses a range of critical thinking skills to evaluate situations, solve problems and make decisions	☐ thinks critically and acts logically to evaluate situations, solve problems and make decisions
☐ uses a variety of learning strategies	☐ explores and uses a variety of learning strategies, with limited direction	☐ selects and uses effective learning strategies	☐ →
		☐ cooperates with others in the effective use of learning strategies	☐ provides leadership in the effective use of learning strategies
Managing Resources			
☐ adheres to established timelines; uses time/schedules/planners effectively	☐ creates and adheres to timelines, with limited direction; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines on an independent basis; prioritizes task; uses time/schedules/planners effectively	☐ creates and adheres to detailed timelines; uses time/schedules/planners effectively; prioritizes tasks on a consistent basis
☐ uses information (material and human resources), as directed	☐ accesses and uses a range of relevant information (material and human resources), with limited direction	☐ accesses a range of information (material and human resources), and recognizes when additional resources are required	☐ uses a wide range of information (material and human resources) in order to support and enhance the basic requirement
☐ uses technology (facilities, equipment, supplies), as directed, to perform a task or provide a service	☐ uses technology (facilities, equipment, supplies), as appropriate, to perform a task or provide a service, with minimal assistance and supervision	☐ selects and uses appropriate technology (facilities, equipment, supplies) to perform a task or provide a service on an independent basis	☐ recognizes the monetary and intrinsic value of managing technology (facilities, equipment, supplies)
☐ maintains, stores and/or disposes of equipment and materials, as directed	☐ maintains, stores and/or disposes of equipment and materials, with limited assistance	☐ maintains, stores and/or disposes of equipment and materials on an independent basis	☐ demonstrates effective techniques for managing facilities, equipment and supplies
Problem Solving and Innovation			
☐ participates in problem solving as a process ☐ learns a range of problem-solving skills and approaches	☐ identifies the problem and selects an appropriate problem-solving approach, responding appropriately to specified goals and constraints	☐ thinks critically and acts logically in the context of problem solving	☐ identifies and resolves problems efficiently and effectively
☐ practices problem-solving skills by responding appropriately to a clearly defined problem, specified goals and constraints, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ applies problem-solving skills to a directed or a self-directed activity, by: – generating alternatives – evaluating alternatives – selecting appropriate alternative(s) – taking action	☐ transfers problem-solving skills to real-life situations, by generating new possibilities ☐ prepares implementation plans ☐ recognizes risks	☐ identifies and suggests new ideas to get the job done creatively, by: – combining ideas or information in new ways – making connections among seemingly unrelated ideas – seeking out opportunities in an active manner

Stage 1— *The student:*	**Stage 2**— *The student:*	**Stage 3**— *The student:*	**Stage 4**— *The student:*
Communicating Effectively			
☐ uses communication skills; e.g., reading, writing, illustrating, speaking	☐ communicates thoughts, feelings and ideas to justify or challenge a position, using written, oral and/or visual means	☐ prepares and effectively presents accurate, concise, written, visual and/or oral reports providing reasoned arguments	☐ negotiates effectively, by working toward an agreement that may involve exchanging specific resources or resolving divergent interests
☐ uses language in appropriate context	☐ uses technical language appropriately	☐ encourages, persuades, convinces or otherwise motivates individuals	☐ negotiates and works toward a consensus
☐ listens to understand and learn	☐ listens and responds to understand and learn	☐ listens and responds to understand, learn and teach	☐ listens and responds to understand, learn, teach and evaluate
☐ demonstrates positive interpersonal skills in selected contexts	☐ demonstrates positive interpersonal skills in many contexts	☐ demonstrates positive interpersonal skills in most contexts	☐ promotes positive interpersonal skills among others
Working with Others			
☐ fulfills responsibility in a group project	☐ ——→——→	☐ seeks a team approach, as appropriate, based on group needs and benefits; e.g., idea potential, variety of strengths, sharing of workload	☐ leads, where appropriate, mobilizing the group for high performance
☐ works collaboratively in structured situations with peer members	☐ cooperates to achieve group results	☐ works in a team or group: – encourages and supports team members – helps others in a positive manner – provides leadership/ followership as required – negotiates and works toward consensus as required	☐ understands and works within the context of the group
☐ acknowledges the opinions and contributions of others in the group	☐ maintains a balance between speaking, listening and responding in group discussions ☐ respects the feelings and views of others		☐ prepares, validates and implements plans that reveal new possibilities
Demonstrating Responsibility			
Attendance			
☐ demonstrates responsibility in attendance, punctuality and task completion	☐ ——→——→	☐ ——→——→	☐ ——→——→
Safety			
☐ follows personal and environmental health and safety procedures	☐ recognizes and follows personal and environmental health and safety procedures	☐ establishes and follows personal and environmental health and safety procedures	☐ transfers and applies personal and environmental health and safety procedures to a variety of environments and situations
☐ identifies immediate hazards and their impact on self, others and the environment	☐ identifies immediate and potential hazards and their impact on self, others and the environment	☐ ——→——→	☐ ——→——→
☐ follows appropriate/emergency response procedures	☐ ——→——→	☐ ——→——→	☐ ——→——→
			☐ demonstrates accountability for actions taken to address immediate and potential hazards
Ethics			
☐ makes personal judgements about whether or not certain behaviours/actions are right or wrong	☐ assesses how personal judgements affect other peer members and/or family; e.g., home and school	☐ assesses the implications of personal/group actions within the broader community; e.g., workplace	☐ analyzes the implications of personal/group actions within the global context
			☐ states and defends a personal code of ethics as required

★Developmental Framework			
• *Simple task* • *Structured environment* • *Directed learning*	• *Task with limited variables* • *Less structured environment* • *Limited direction*	• *Task with multiple variables* • *Flexible environment* • *Self-directed learning, seeking assistance as required*	• *Complex task* • *Open environment* • *Self-directed/self-motivated*

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GENERIC RATING SCALE

SCALE	**RUBRIC STATEMENT** (included in assessment tool/statements in *italics* are optional) ***The student:***	**IS TASK/ PROJECT COMPLETED?**	**PROBLEM SOLVING:** **STUDENT INITIATIVE VS TEACHER DIRECTION/ SUPPORT**	**USE OF TOOLS, MATERIALS, PROCESSES**	***STANDARDS OF QUALITY/ PRODUCTIVITY***	***TEAMWORK LEADERSHIP***	***SERVICE CLIENT/ CUSTOMER***
4	exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*	Exceeds defined outcomes.	Plans and solves problems effectively and creatively in a self-directed manner.	Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	*Quality, particularly details and finishes, and productivity are consistent and exceed standards.*	*Leads others to contribute team goals.*	*Analyzes and provides effective client/customer services beyond expectations.*
3	meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*	Meets defined outcomes.	Plans and solves problems in a self-directed manner.	Tools, materials and/or processes are selected and used efficiently and effectively.	*Quality and productivity are consistent.*	*Works cooperatively and contributes ideas and suggestions that enhance team effort.*	*Analyzes and provides effective client/customer services.*
2	meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*	Meets defined outcomes.	Plans and solves problems with limited assistance.	Tools, materials and/or processes are selected and used appropriately.	*Quality and productivity are reasonably consistent.*	*Works cooperatively to achieve team goals.*	*Identifies and provides customer/client services.*
1	meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*	Meets defined outcomes.	Follows a guided plan of action.	A limited range of tools, materials and/or processes are used appropriately.	*Quality and productivity are reasonably consistent.*	*Works cooperatively.*	*Provides a limited range of customer/client services.*
0	has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.	Has not completed defined outcomes.		Tools, materials and/or processes are used inappropriately.			

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INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning • accurately describes an issue on which people disagree • poses an important question regarding the issue • accesses basic in-school/community information sources regarding the issue • uses one or more information-gathering techniques	**Preparation and Planning** • accurately describes an issue on which people disagree, explaining areas of disagreement • poses one or more thoughtful questions regarding the issue • accesses a range of relevant in-school/community resources • uses a range of information-gathering techniques	**Preparation and Planning** • accurately describes an issue on which people disagree, explaining specific causes of disagreement • poses thoughtful questions regarding the issue • accesses a range of relevant information sources and recognizes when additional information is required • demonstrates resourcefulness in collecting data
Analyzing Perspectives • clarifies different points of view regarding the issue; *e.g., social, economic, environmental* • states a position on the issue and logical reasons for adopting that position • states an opposing position on the issue and logical reasons for adopting that position • identifies sources of conflict among different positions • distinguishes between fact and fiction/opinion/theory	**Analyzing Perspectives** • categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related* • states a position on the issue and logical reasons for adopting that position • states two or more opposing positions on the issue and logical reasons for adopting each position • describes interrelationships among different perspectives/points of view • determines accuracy/currency/reliability of information and ideas	**Analyzing Perspectives** • categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related, scientific, political* • states a position on the issue and insightful reasons for adopting that position • states three or more opposing positions on the issue and thoughtful reasons for adopting each position • analyzes interrelationships among different perspectives/points of view • recognizes underlying bias/assumptions/values in information and ideas
Collaboration and Teamwork • shares work appropriately among group members • respects the views of others	**Collaboration and Teamwork** • shares work appropriately among group members • respects and considers the views of others • negotiates solutions to problems	**Collaboration and Teamwork** • shares work appropriately among group members • respects and considers the views of others • negotiates with sensitivity solutions to problems
Evaluating Choices/Making Decisions • identifies useful alternatives regarding the issue • establishes criteria for assessing each alternative; *e.g., social, economic, environmental* • selects an appropriate alternative based on established criteria • reflects on strengths/weaknesses of decisions by considering consequences • communicates information in a logical sequence to justify choices/decisions made	**Evaluating Choices/Making Decisions** • identifies important and appropriate alternatives regarding the issue • establishes knowledge- and value-based criteria for assessing each alternative; *e.g., social, economic, environmental* • selects an appropriate alternative by showing differences among choices • assesses strengths/weaknesses of decisions by considering consequences • communicates ideas in a logical sequence with supporting detail to justify choices/decisions made	**Evaluating Choices/Making Decisions** • describes in detail important and appropriate alternatives regarding the issue • establishes knowledge- and value-based criteria for assessing each alternative; *e.g., social, economic, environmental* • selects an appropriate and useful alternative by showing differences among choices • assesses strengths/weaknesses of decisions by considering consequences and implications • communicates thoughts/feelings/ideas clearly to justify choices/decisions made

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Management • prepares self for task • organizes and works in an orderly manner • carries out instructions accurately • uses time effectively	**Management** • prepares self for task • organizes and works in an orderly manner • interprets and carries out instructions accurately • plans and uses time effectively • adheres to routine procedures	**Management** • prepares self for task • organizes and works in an orderly manner • interprets and carries out instructions accurately • plans and uses time effectively in a logical sequence • displays leadership in adhering to routine procedures • attempts to solve problems prior to requesting help
Teamwork • cooperates with group members • shares work appropriately among group members	**Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates solutions to problems	**Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates with sensitivity solutions to problems • displays effective communication skills
Use of Equipment and Materials • selects and uses appropriate equipment/materials • follows safe procedures/techniques • weighs and measures accurately • returns clean equipment/materials to storage areas	**Use of Equipment and Materials** • selects and uses appropriate equipment/materials • models safe procedures/techniques • weighs and measures accurately • practises proper sanitation procedures • minimizes waste of materials • advises of potential hazards and necessary repairs	**Use of Equipment and Materials** • selects and uses equipment/materials independently • demonstrates concern for safe procedures/techniques • weighs and measures accurately and efficiently • practises proper sanitation procedures • minimizes waste of materials • anticipates potential hazards and emergency response
Investigative Techniques • gathers and applies information from at least one source • makes predictions that can be tested • sets up and conducts experiments to test a prediction • distinguishes between manipulated/responding variables • obtains results that can be used to determine if some aspect of the prediction is accurate • summarizes important experimental outcomes	**Investigative Techniques** • gathers and applies information from a variety of sources • makes predictions that can be tested • plans, sets up and conducts experiments to test a prediction • identifies and explains manipulated/responding variables • obtains accurate results that confirm/reject the prediction • summarizes and applies experimental outcomes	**Investigative Techniques** • uses relevant information to explain observations • makes predictions that can be tested • plans, sets up and conducts experiments to test a prediction • analyzes relationships among manipulated/responding variables • obtains accurate results that confirm/reject prediction and answer related questions • summarizes, applies and evaluates experimental outcomes

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ASSESSMENT FRAMEWORK: NEGOTIATION AND DEBATE

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning	**Preparation and Planning**	**Preparation and Planning**
• accurately describes an issue on which people disagree	• accurately describes an issue on which people disagree, explaining areas of disagreement	• accurately describes an issue on which people disagree, explaining specific causes of disagreement
• poses an important question regarding the issue	• poses one or more thoughtful questions regarding the issue	• poses thoughtful questions regarding the issue
• accesses basic in-school/community information sources regarding the issue	• accesses a range of relevant in-school/community resources	• accesses a range of relevant information sources and recognizes when additional information is required
• uses one or more information-gathering techniques	• uses a range of information-gathering techniques	• demonstrates resourcefulness in collecting data
Analyzing Perspectives	**Analyzing Perspectives**	**Analyzing Perspectives**
• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and logical reasons for adopting that position	• states a position on the issue and insightful reasons for adopting that position
• explains why the issue is important by presenting examples of possible consequences	• explains why the issue is important by presenting examples of possible consequences	• explains why the issue is important by presenting examples of possible consequences and implications
• clarifies different points of view regarding the issue; *e.g., social, economic, environmental*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related*	• categorizes different points of view regarding the issue; *e.g., cultural, ethical, economic, environmental, health-related, scientific, political*
• distinguishes between fact and fiction/opinion/theory	• determines accuracy/currency/reliability of information and ideas	• recognizes underlying bias/assumptions/values in information and ideas
Collaboration and Teamwork	**Collaboration and Teamwork**	**Collaboration and Teamwork**
• works with a range of peer members	• works with a range of peer members	• works with a wide range of peer members
• shares information/opinions/suggestions through group discussion	• shares information/opinions/suggestions, maintaining a balance between speaking and listening	• shares information/opinions/suggestions, maintaining a balance between speaking and listening
• listens to and respects the views of others	• listens to and respects the views of others, requesting clarification as necessary from other group members	• listens to and respects the views of others, requesting clarification as necessary from other group members
Negotiating and Debating	**Negotiating and Debating**	**Negotiating and Debating**
• presents a convincing argument in logical sequence supporting a position adopted on the issue	• presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance	• presents a convincing argument in logical sequence supporting a position adopted, conveying points in order of importance and backing each with sound evidence
• provides a relevant response to opposing arguments	• provides a relevant and convincing response to opposing arguments	• provides a relevant and convincing rebuttal to opposing arguments
• speaks clearly so the argument can be understood	• speaks clearly without hesitation so the argument can be understood	• speaks clearly without hesitation so the argument can be understood by all listeners
• establishes a shared understanding of key alternatives and consequences relevant to the issue	• negotiates a shared agreement on preferred alternatives relevant to the issue	• negotiates a shared agreement on preferred alternatives by resolving divergent points of view

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ASSESSMENT FRAMEWORK: PRESENTATIONS/REPORTS CTSPRE

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning	**Preparation and Planning**	**Preparation and Planning**
• sets goals and follows instructions accurately	• sets goals and describes steps to achieve them	• sets goals and describes steps to achieve them
• responds to directed questions and follows necessary steps to find answers	• uses personal initiative to formulate questions and find answers	• uses personal initiative to formulate questions and find answers
• accesses basic in-school/community information sources	• accesses a range of relevant in-school/community resources	• accesses a range of relevant information sources and recognizes when additional information is required
• interprets and organizes information into a logical sequence	• interprets, organizes and combines information into a logical sequence	• interprets, organizes and combines information in creative and thoughtful ways
• records information accurately, using correct technical terms	• records information accurately with appropriate supporting detail and using correct technical terms	• records information accurately, using appropriate technical terms and supporting detail
• uses time effectively	• plans and uses time effectively	• plans and uses time effectively, prioritizing tasks on a consistent basis
	• gathers and responds to feedback regarding approach to task and project status	• assesses and refines approach to task and project status based on feedback and reflection
Presentation	**Presentation**	**Presentation**
• demonstrates effective use of at least one medium of communication: *e.g.,* *Written**: spelling, punctuation, grammar, basic format* *Oral**: voice projection, body language* *Audio-Visual**: techniques, tools*	• demonstrates effective use of at least two communication media: *e.g.,* *Written**: spelling, punctuation, grammar, format (formal/informal)* *Oral**: voice projection, body language, appearance* *Audio-Visual**: techniques, tools, clarity*	• demonstrates effective use of a variety of communication media: *e.g.,* *Written**: spelling, punctuation, grammar, format (formal/informal, technical/literary)* *Oral**: voice projection, body language, appearance, enthusiasm, evidence of prior practice* *Audio-Visual**: techniques, tools, clarity, speed and pacing*
• uses correct grammatical convention and technical terms through proofreading/editing	• maintains acceptable grammatical and technical standards through proofreading and editing	• maintains acceptable grammatical and technical standards through proofreading and editing
• provides an introduction that describes the purpose of the project	• provides an introduction that describes the purpose and scope of the project	• provides an introduction that describes the purpose and scope of the project
• communicates information in a logical sequence	• communicates ideas into a logical sequence with sufficient supporting detail	• communicates thoughts/feelings/ideas clearly to justify or challenge a position
• states a conclusion based on a summary of facts	• states a conclusion by synthesizing the information gathered	• states a conclusion by analyzing and synthesizing the information gathered
• provides a reference list of three or more basic information sources	• provides a reference list that includes five or more relevant information sources	• gives evidence of adequate research through a reference list including seven or more relevant information sources

ASSESSMENT FRAMEWORK: RESEARCH PROCESS

INTRODUCTORY	INTERMEDIATE	ADVANCED
The student:	*The student:*	*The student:*
Preparation and Planning • sets goals and follows instructions accurately • adheres to established timelines • responds to directed questions and follows necessary steps to find answers • uses time effectively	**Preparation and Planning** • sets goals and establishes steps to achieve them • creates and adheres to useful timelines • uses personal initiative to formulate questions and find answers • plans and uses time effectively	**Preparation and Planning** • sets clear goals and establishes steps to achieve them • creates and adheres to detailed timelines • uses personal initiative to formulate questions and find answers • plans and uses time effectively, prioritizing tasks on a consistent basis
Information Gathering and Processing • accesses basic in-school/community information sources • uses one or more information-gathering techniques • interprets and organizes information in a logical sequence • records information accurately, using correct technical terms • distinguishes between fact and fiction/opinion/theory • responds to feedback when current approach is not working	**Information Gathering and Processing** • accesses a range of relevant in-school/community resources • uses a range of information-gathering techniques • interprets, organizes and combines information into a logical sequence • records information accurately with appropriate supporting detail and using correct technical terms • determines accuracy/currency/reliability of information sources • gathers and responds to feedback regarding approach to the task	**Information Gathering and Processing** • accesses a range of relevant information sources and recognizes when additional information is required • demonstrates resourcefulness in collecting data • interprets, organizes and combines information in creative and thoughtful ways • records information accurately with appropriate supporting detail and using correct technical terms • recognizes underlying bias/assumptions/values in information sources • assesses and refines approach to the task and project status based on feedback and reflection
Collaboration and Teamwork • cooperates with group members • shares work appropriately among group members	**Collaboration and Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates solutions to problems	**Collaboration and Teamwork** • cooperates with group members • shares work appropriately among group members • negotiates with sensitivity solutions to problems • displays effective communication and leadership skills
Information Sharing • demonstrates effective use of one or more communication media; *e.g., written, oral, audio-visual* • communicates information in a logical sequence • uses correct grammatical convention and technical terms • cites three or more basic information sources	**Information Sharing** • demonstrates effective use of two or more communication media; *e.g., written, oral, audio-visual* • communicates ideas in a logical sequence with sufficient supporting detail • maintains acceptable grammatical and technical standards • cites five or more relevant information sources	**Information Sharing** • demonstrates effective use of a variety of communication media; *e.g., written, oral, audio-visual* • communicates thoughts/feelings/ideas clearly to justify or challenge a position • maintains acceptable grammatical and technical standards • gives evidence of adequate information gathering by citing seven or more relevant information sources

ASSESSMENT GUIDE: Career Profile MECCPR

STANDARD	Students working at STANDARD must complete all sections of the career profile and demonstrate standard provided in column at the right. Use Presentations/Reports reference guide for rating scale.

Area of Career Exploration:

Criteria	Minimum Standard Introductory	Minimum Standard Intermediate	Minimum Standard Advanced	Observed Rating
Job Title	1	2	3	______
Task Description	1	2	3	______
Working Conditions	1	2	3	______
Educational Qualifications	1	2	3	______
Employment Opportunities	1	2	3	______
Potential for Advancement	1	2	3	______
Salary Range Benefits	1	2	3	______
How would you enjoy the work? Aspects you would not enjoy?	1	2	3	______
References used.	1	2	3	______

Rating Scale:

- **4** Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
- **3** Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
- **2** Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
- **1** Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
- **0** Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/ COMMENTS:

ASSESSMENT GUIDE: Customer Service Project MECCSP

STANDARD	Students working at STANDARD must demonstrate the level of competency as indicated in module conditions and criteria and the standard indicated in rating columns below. The space to the right is provided for the recording of student performance.

CRITERIA	PROBLEM			
	Minimum Standard Introductory	**Minimum Standard Intermediate**	**Minimum Standard Advanced**	**Observed Rating**
The student: **Customer Need** ☐ greets customer in appropriate manner ☐ is friendly/helpful while receiving order ☐ asks leading questions to prompt customer response	2	2	3	
Writing Work Order ☐ provides proper opening and closing ☐ enters required details ☐ uses appropriate service data (serial #, etc.) ☐ is legible	2	2	3	
Performs Service ☐ responds to customer need ☐ identifies and reports other potential problems ☐ manages time efficiently ☐ shows eagerness, enthusiasm for work ☐ is ethical	2	2	3	
Work Collaboratively ☐ is able to get along with co-workers ☐ takes responsibility for balanced work load ☐ contributes to problem solving and decision making	2	2	3	
Quality of Service ☐ meets work order request ☐ exhibits completeness in adjustments, replacement ☐ uses supplies effectively, tools used correctly ☐ cleans/restores to original condition ☐ reports service performed	2	2	3	
Maintenance Schedule ☐ includes unit descriptive information ☐ includes service variables ☐ develops a comprehensive schedule	2	2	3	

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. leads others to contribute to team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Identifies and provides customer/client services.*

1 Completed tasks as directed, demonstrating basic skills by following a guided course of action. *Quality and productivity meet standard but are inconsistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/ COMMENTS:

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ASSESSMENT CHECKLIST: Health and Safety MECH&S

STANDARD	Students working at STANDARD must demonstrate the level indicated in the specified module conditions and criteria. The column to the right indicates the minimum rating for at standard performance for introductory, intermediate and advanced modules. The blank space to the far right provides space for recording observed performance of a student.

CRITERIA	RATING			
	Minimum Standard Introductory	**Minimum Standard** Intermediate	**Minimum Standard** Advanced	**Observed Rating**
The student: ☐ understands and follows personal, environmental and shop/lab safety and health procedures	2	2	3	________
☐ uses personal protective equipment including shop coat/coveralls	2	2	3	________
☐ uses tools/equipment safely	2	2	3	________
☐ cleans and organizes workstation/facility	2	2	3	________
☐ carries out specific health and safety concerns as listed in specific module conditions and criteria	2	2	3	________

Rating Scale:

4 Transfers and applies personal, environmental and shop/lab safety and health procedures in an exemplary manner.

3 Recognizes and follows personal, environmental and lab/shop safety and health procedures.

2 Recognizes and follows personal, environmental and shop/lab safety and health procedures with occasional prompting.

1 Follows personal, environmental and lab/shop procedures with some prompting.

REFLECTIONS/COMMENTS:

TASK					
Identifying the Problem	4	3	2	1	N/A
Correction of the Problem	4	3	2	1	N/A
Evaluation of the Problem	4	3	2	1	N/A

Rating Scale:

4	Problems were solved in effective and creative ways in a self-directed manner. Follows appropriate steps to determine the extent of the problem and is able to recommend a number of possible solutions. Chooses and evaluates the best possible solution.
3	Understands the problem. Follows appropriate steps to determine the extend of the problem and is able to recommend a number of solutions.
2	Understands the problem and with limited guidance is able to determine the extent of the problem and able to recommend two or more solutions.
1	Has some understanding of the problem. With assistance can recommend one or more solution to the problem.

Performance Rating:
See Module Criteria and Conditions

PROBLEM SOLVING CHECKLIST:

Problem: (See Module Criteria and Conditions)

____

____

____

____

The student:

Identifying the Problem:
- ☐ uses proper tools, equipment and resources
- ☐ pinpoints faulty system(s) and/or subsystem(s)
- ☐ pinpoints faulty component(s)
- ☐ uses acceptable procedure
- ☐ documents the problem

Correction/Solution
- ☐ uses acceptable process
- ☐ uses proper tools and/or equipment
- ☐ restores to acceptable standard
- ☐ uses most cost-effective approach

Evaluation of Problem
- ☐ is able to verify corrected problem
- ☐ is able to recommend ways to avoid/minimize problem in future

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Laboratory Practices MEC1010–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ organizes and works in an orderly manner ☐ selects and uses tools safely ☐ maintains a safe and tidy workplace	2	______
Part 2	**Modes of Transportation** ☐ lists common modes of transportation related to land, air, sea and space travel ☐ describes systems common to all modes of transportation; e.g.: – propulsion – guidance and control – suspension/structural systems	1	______
Part 3	**Researches, Designs and Builds** ☐ selects and uses resources to research project ☐ designs a concept vehicle ☐ builds a concept vehicle ☐ tests and evaluates concept vehicle	1	______

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Vehicle Service & Care MEC1020–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ uses prescribed personal protective equipment ☐ fulfils given clean-up responsibilities ☐ follows proper lifting, handling and storage procedures	2	
Part 2	**Service Schedule** ☐ selects and uses the appropriate resources ☐ develops a service schedule: – includes make, model and year of vehicle – includes vehicle factors such as distance, time and operating conditions – lists checks pertaining to fluids, filters, tires, battery, belts/chains, lights and body	1	
Part 3	**Inspections** ☐ inspects, adjusts or replaces items as specified on the service schedule	1	
Part 4	**Exterior/Interior Surfaces** ☐ selects and uses products to enhance exterior surfaces ☐ selects and uses products to enhance interior surfaces ☐ selects and uses recommended equipment	1	

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

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TASK ASSESSMENT CHECKLIST: Engine Fundamentals	**MEC1040–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses the appropriate tools and equipment ☐ understands the hazards associated with the use and storage of gasoline ☐ handles gasoline in proper manner	2	________
Part 2	**Engine Operating Principles** ☐ selects and uses resources effectively ☐ explains the operating principles of a two-stroke cycle ☐ explains how a four-stroke cycle engine operates	1	________
Part 3	**Engine Condition** ☐ given an engine, determines the mechanical condition including compression pressures ☐ determines spark voltages and timing settings ☐ determines type of fuel supply to the cylinder ☐ measures engine bore and stroke ☐ determines the engine displacement	1	________
Part 4	**Combustion By-products** ☐ lists combustion by-products; e.g.: – carbon dioxide – carbon monoxide – oxides of nitrogen – particulates ☐ states the impact on the environment	1	________

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Electrical Fundamentals MEC1090–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ uses personal protective equipment as required ☐ selects and uses electrical meters correctly ☐ observes recommended procedures when handling/servicing batteries	2	______
Part 2	**Electrical Principles** ☐ recognizes series and parallel circuits on vehicles ☐ recognizes open, closed, shorted and grounded condition ☐ selects and uses voltmeter correctly ☐ selects and uses ammeter correctly ☐ selects and uses ohmmeter correctly ☐ uses meters to check lighting, charging and starting system ☐ tests battery state of charge and condition	1	______

Rating Scale:

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2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Pneumatic & Hydraulic Systems MEC1110–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ lists dangers involved with high pressure liquids and gases ☐ understands and follows safe practices when working with pressurized pneumatic and hydraulic systems. ☐ understands and follows established clean-up procedures	2	
Part 2	**Operating Principles** ☐ states operating principles for pneumatics ☐ states operating principles for hydraulics ☐ lists components involved in pneumatic and hydraulic systems ☐ states where systems are used on vehicles	1	
Part 3	**Operating Systems** ☐ recognizes, operates and tests pneumatic system ☐ recognizes, operates and tests hydraulic system	1	

Rating Scale:

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1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Mechanical Systems MEC1130–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab routines ☐ selects and uses tools and equipment safely ☐ uses guards and shields as instructed	2	
Part 2	**Mechanical Principles** ☐ describes simple machines and their purpose ☐ lists types of mechanical motion ☐ states how mechanical energy is converted into other energy forms ☐ provides examples of mechanical devices on vehicles	1	
Part 3	**Mechanical Systems** ☐ given a mechanical system, determines: – torque and gear ratio – mechanical advantage from input to output – coefficient of friction	1	

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Ride & Control Systems MEC1150-1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab routines ☐ selects and uses floor jacks and safety stands	2	
Part 2	**Ride and Control Principles** ☐ reports on operation and purpose of suspension, steering and braking systems as applied to land vehicle and aircraft ☐ reports on how hydraulics, pneumatics, electrical are applied to ride and control systems	1	
Part 3	**Inspection and Service** ☐ identifies suspension, steering and brake system components ☐ locates points of service/wear on ride and control system ☐ lubricates components where possible ☐ inspects and repacks wheel bearing ☐ identifies tire wear patterns	1	

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Vehicle Structures & Materials MEC1160–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab routines ☐ recognizes health hazards associated with coated surfaces ☐ demonstrates safe handling and disposal of hazardous materials	2	________
Part 2	**Vehicle Structures** ☐ reports how the function of a vehicle dictates the materials used in construction for interior and exterior surfaces ☐ lists materials used in vehicle construction ☐ lists types of fasteners ☐ lists types of structural coatings utilized	1	________
Part 3	**Identification** ☐ identifies structural parts on a vehicle ☐ identifies materials used to manufacture parts ☐ identifies fasteners and coatings	1	________

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Metal Forming & Finishing MEC1170–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab routines ☐ uses personal protection equipment as instructed ☐ selects and uses appropriate tools and equipment associated with metal forming and finishing	2	______
Part 2	**Distortion and Corrosion** ☐ states effects of distortion and corrosion on ferrous sheet metal ☐ states characteristics of sheet metal that has been damaged	1	______
Part 3	**Repair** ☐ repairs a minor dent in a panel ☐ repairs a rust out in a panel	1	______

Rating Scale:	***REFLECTIONS/COMMENTS:***
4 *Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. Quality, particularly details and finishes and productivity are consistent and exceed standards.* *3* *Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. Quality and productivity are consistent.* *2* *Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. Quality and productivity are reasonably consistent.* *1* *Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. Quality and productivity are reasonably consistent.*	

Module Learner Expectation:	*The student will:* - **apply metal forming and finishing skills to repair minor panel damage.**

Assessment Components	**Details**	**Indicators**
Tool Use	*The student:* • selects and uses proper hammers, dollies to create the desired shape	• physically returned to original shape (± 4 mm)
Plastic Filler	• mixes, applies and levels filler • correctly edges filler • selects and uses correct file and sand paper to create proper contour	• sight and feel test indicates correct contour and surface appearance
Use of Oxyacetylene and/or GMAW welder	• removes rust out portion of panel • tacks weld patch in place • seams weld patch	• all rust removed and surface patched and refinished to original condition
Picking and Filing	• levels panel by picking and filing to required contour	• pick and file to within ± 4 mm

TASK ASSESSMENT CHECKLIST: Surface Preparation MEC1190–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 for safety and 1 for the remainder of the criteria.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
	The student:		
Part 1	**Safety** ☐ follows established shop/lab procedures related to control abrasive dust and chemical fumes ☐ selects and uses tools and equipment associated with surface preparation ☐ uses WHMIS Material Safety Data Sheets (MSDS) as required	2	
Part 2	**Products, Equipment and Procedures** ☐ lists surface conditions ☐ describes repair procedures for each condition ☐ lists abrasives and alternatives for surface preparation ☐ uses appropriate abrasives and other surface preparation materials ☐ lists and describes tools and equipment required	1	
Part 3	**Surface Preparations on a Given Surface** ☐ analyzes and describes surface preparation process ☐ performs surface preparation	1	

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Vehicle Detailing MEC2010–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows lab/shop procedures ☐ is sensitive to environmental concerns when using cleaning and waxing agents ☐ recognizes and observes hazards associated with cleaning and waxing agents ☐ identifies products that are less hazardous	2	________
Part 2	**Identification of Material and Products** ☐ lists and describes materials and products used for detailing vehicles ☐ lists and describes possible trim additions	2	________
Part 3	**Exterior Surface Including Engine Compartment** ☐ selects and uses appropriate cleaning and treatment products on paint, glass, vinyl and rubber	2	________
Part 4	**Trim and Accessory Parts** ☐ selects and uses resources efficiently ☐ identifies parts/components correctly ☐ selects and uses appropriate tools for trim/accessory installation ☐ installs trim/accessories as instructed	2	________

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Vehicle Maintenance MEC2020–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ properly handles fluids ☐ safely handles chemicals ☐ selects and correctly interprets WHMIS data	2	______
Part 2	**Service Schedule** ☐ develops a service schedule using appropriate resources ☐ includes make, model, year and serial number ☐ includes vehicle factors such as distance, time and operating condition ☐ includes items to be checked, serviced or replaced ☐ covers all systems, subsystems and components	2	______
Part 3	**Inspection** ☐ selects and uses appropriate resources ☐ inspects all items as identified by service schedule	2	______
Part 4	**Service and Repair** ☐ services and repairs vehicle according to service schedule	2	______

Rating Scale:

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0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Lubrication & Cooling MEC2030-1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Safety** ☐ follows lab/shop procedures ☐ selects and uses appropriate tools and equipment ☐ selects, uses and stores vehicle fluids according to accepted practices	2	
Part 2	**Fluid Conditions** ☐ lists components and describes engine lubrication and cooling systems function and operation ☐ lists properties and ratings of coolant and oils	2	
Part 3	**Service a Vehicle** ☐ diagnoses cooling and lubrication system faults ☐ services/repairs cooling system ☐ services/repairs lubrication system	2	

Rating Scale:

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0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Fuel & Exhaust Systems	**MEC2040–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
	The student:		
Part 1	**Safety** ☐ follows lab/shop procedures ☐ selects and uses appropriate tools and equipment ☐ knows the location(s) of the appropriate fire extinguishers and how to use them in the event of fire	2	______
Part 2	**Combustion of Fuels** ☐ explains the importance of varying air fuel ratios in combustion processes ☐ describes the importance of air flow, atomization, and pre- and post-ignition ☐ explains the importance of exhaust system design and need to reduce back pressure	2	______
Part 3	**Diagnoses and Repair** ☐ selects and uses appropriate resources ☐ diagnoses fuel system faults ☐ diagnoses exhaust system faults ☐ services/repairs fuel and exhaust system	2	______

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Alternate Fuel Engines MEC2050–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows lab/shop procedures ☐ follows prescribed precautions when starting, stopping, parking, storing and refuelling alternate fuel vehicles ☐ follows safe procedures for storage of alternate fuels	2	________
Part 2	**Alternate Fuels** ☐ identifies alternate fuels in use or under development ☐ indicates factors that dictate the use of alternate fuels ☐ explains the components required and modification necessary to accommodate the use of alternate fuels	2	________
Part 3	**Service** ☐ determines the specific service requirements of an alternate fuel vehicle ☐ completes a service schedule for a given fuel and vehicle ☐ services an alternate fuelled vehicle	2	________

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Ignition Systems MEC2060–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ observes shop/lab procedures ☐ explains dangers of coming into direct contact with high voltage and currents	2	
Part 2	**Ignition Spark** ☐ explains how timed high voltage spark is produced in magneto, point and electronic ignition systems	2	
Part 3	**Ignition Problems** ☐ diagnoses ignition problems in magnetos, point and electronic systems	2	
Part 4	**Service Ignition System** ☐ services magneto/point ignition system ☐ services electronic ignition system	2	

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Emission Controls	**MEC2070–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows shop/lab procedures ☐ selects and uses tools and equipment appropriately ☐ selects and uses personal protective equipment appropriately ☐ recognizes and controls health hazards associated with engine emissions	2	________
Part 2	**Pollutants** ☐ identifies and lists vehicle pre- and post-combustion emissions ☐ identifies the effects of vehicle pollutants on the environment ☐ describes regulations pertaining to emission standards ☐ compares emissions from gasoline engines to alternate fuel engines	2	________
Part 3	**Emission Control Systems** ☐ identifies and describes types of emission control systems	2	________
Part 4	**Components on a Given Vehicle** ☐ identifies/locates emission control components ☐ explains how components work to reduce emissions ☐ checks a system for efficiency	2	________
Part 5	**Diagnose and Service on a Given Vehicle** ☐ uses a gas analyzer to check vehicle emission ☐ compares data to specifications and diagnosing faults ☐ services emission control system	2	________

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Electrical Components MEC2090–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Safety** ☐ follows shop/lab procedures when working with electrical circuits ☐ explains how to avoid sparks, grounds and electrical shorts ☐ understands to need to observe proper polarity	2	______
Part 2	**Electrical Systems** ☐ describes lighting, charging and starting electrical systems ☐ lists components in each electrical system ☐ describes the operation of each electrical system	2	______
Part 3	**Testing Systems** ☐ selects and uses voltmeter, ammeter and ohmmeter correctly ☐ tests for open and closed circuits ☐ tests for load voltage and voltage drops ☐ tests for current draw ☐ tests for resistances ☐ recognizes abnormal electrical circuit conditions including grounds and shorts	2	______
Part 4	**Testing and Service** ☐ disassembles, tests and reassembles starter motor ☐ disassembles, tests and reassembles alternator ☐ tests assembled starter/alternator on or off of vehicle	2	______

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Power Assist Accessories MEC2100–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop/lab procedures ☐ safely uses tools and equipment ☐ observes personal safety and vehicle care	2	______
Part 2	**Power Assist Accessories** ☐ lists available power assist accessories on vehicles ☐ states how power assist accessories function to perform or assist mechanical tasks ☐ lists the components that make up power assist systems	2	______
Part 3	**Components** ☐ describes function and operation of power assist components ☐ determines system(s) level of performance through testing	2	______
Part 4	**Service and Repair** ☐ selects and uses appropriate tools to identify problem ☐ services/repairs a system according to manufacturer's recommendations ☐ evaluates repair and possible factors that may have caused a component to malfunction	2	______

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Braking Systems MEC2110–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
	The student:		
Part 1	**Safety** ☐ follows established shop/lab procedures ☐ selects and uses proper personal protective equipment ☐ follows safe practices when working with asbestos ☐ follows established lifting and jacking procedures	2	______
Part 2	**Brake Design** ☐ identifies and describes brake systems and components ☐ explains operation and function of service and emergency brake systems	2	______
Part 3	**Analyze Brake Systems** ☐ lists factors/symptoms of worn or defective brake system components ☐ selects and uses tools and equipment to check for defective brake system ☐ inspects and identifies brake system components requiring service	2	______
Part 4	**Service and Repair** ☐ selects and uses tools and equipment ☐ services drum and disc brake systems ☐ services emergency brake systems	2	______
Part 5	**Resources** ☐ selects and uses appropriate resources ☐ interprets specifications/information to service brake systems	2	______

Rating Scale:

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REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Braking Systems MEC2110–2

Module Learner Expectation:	*The student will:* • inspect and analyze disc and drum brake systems.

NOTE: Student should have the opportunity to inspect one disc, drum brake and emergency brake assembly.

SAMPLE ITEM(S)

BRAKE SYSTEM INSPECTION

Factors/Symptoms of Worn or Defective Brake System

The student:

- Inspects brake system components to determine serviceability:
  - brake pedal action, checking pedal height, pedal reserve and free play
  - brake fluid condition, level and leaks
  - drum brake:
    - lining - condition, thickness
    - hardware - springs, clips, pins, self-adjusters
    - wheel cylinder - leakage, boot condition, bleeder screw
    - drum - size, condition, scoring, bellmouthing
  - disc brake:
    - brake pad lining - thickness, condition
    - calliper - condition, leaks, sticking
    - hardware - retaining/guide pins, clips, sleeves/bushings
    - disc - condition, thickness, parallelism, run out, scoring
  - park brake:
    - pedal/lever operation
    - cable/housing - condition, and movement
    - hardware - adjusters, equalizer strut, lever condition
  - lines:
    - condition, leaks, clips in place
  - hoses:
    - condition, cracks, leaks, clips in place
  - master cylinder:
    - condition, fluid leaks, pedal feel, pedal build-up, pedal falling away (checks indicate condition of cups, free compensating port)
  - control valves:
    - condition of metering and proportioning valve
  - other:
    - warning lights, brake lights, and other conditions affecting brakes, i.e., tires, wheel bearings, suspension, steering
- Identifies symptoms before road test such as:
  - brake warning light on
  - low brake fluid level
  - brake fluid leaks
  - incorrect brake pedal feel - spongy, little or no reserve, noises

Factors/Symptoms of Worn or Defective Brake System (cont'd)

The student:

- Factors/Symptoms during road test:
  - brakes pull to one side
  - noisy brakes - squeal, scraping, clunk
  - brakes locking or grabbing
  - little or no stopping ability
  - pulsating pedal
  - vehicle vibrates
- Factors/Symptoms when vehicle on the hoist:
  - brake fluid visible on backing plates, line/hoses, connections, master cylinder
  - excessive brake drag
  - loose wheel bearings, suspension steering components
  - defective master cylinder, wheel cylinder, calliper
  - worn/defective brake drum or rotor
  - uneven tire condition and/or pressures
  - worn or defective brake linings or pads

TASK ASSESSMENT CHECKLIST: Hydraulic Accessories MEC2120–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses tools, equipment and resources correctly ☐ selects and uses personal protective equipment as required ☐ understands hazards associated with pressurized hydraulic equipment	2	
Part 2	**Hydraulic Principles** ☐ selects and uses required hydraulic resources ☐ lists and explains function of hydraulic systems and components	2	
Part 3	**Service Techniques** ☐ selects and uses hydraulic service resources ☐ lists procedures and techniques in servicing hydraulic system/components ☐ develops a service schedule	2	
Part 4	**Service** ☐ carries out regular service requirements on a designated system ☐ locates and analyses a system fault ☐ services/repairs components	2	

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Drive Trains MEC2130–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses tools, equipment and materials ☐ recognizes problems associated with lifting heavy objects and exercises proper lifting and handling techniques	2	
Part 2	**Function of Drive Train** ☐ lists drive train components and states their function ☐ explains the inter-relationship between drive train components ☐ develops a service schedule for drive train components	2	
Part 3	**Inspection and Service** ☐ inspects and diagnoses drive train components ☐ services drive train components ☐ removes and replaces drive train components	2	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Transmissions/Transaxles MEC2140–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses tools, equipment and supplies ☐ selects and uses vehicle protection equipment ☐ follows proper lifting practices to avoid back injuries	2	
Part 2	**Power Path** ☐ identifies drive train components of a vehicle equipped with manual transmission/transaxle ☐ explains flow of power in various gear selector positions ☐ lists problem areas in clutches and transmissions	2	
Part 3	**Inspection and Service** ☐ inspects and reports on a manual drive train ☐ diagnoses and lists possible system faults in drive train ☐ services drive train ☐ removes, inspects and replaces clutch assembly ☐ disassembles, inspects and reassembles manual transmission	2	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Suspension Systems MEC2150–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop/lab procedures ☐ selects and uses tools, equipment and materials ☐ selects and uses personal protective equipment	2	
Part 2	**Identification of Components** ☐ identifies and lists suspension components ☐ identifies parts/components subject to wear	2	
Part 3	**Identification of Defective Components** ☐ identifies worn or defective suspension components ☐ analyzes reasons for worn or defective components ☐ identifies driveability problems associated with worn or defective components	2	
Part 4	**Service and Repair** ☐ selects and uses service resources ☐ selects and uses tools, equipment and materials ☐ removes and replaces necessary suspension components	2	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Steering Systems MEC2160–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses the appropriate tools, equipment and materials ☐ understands and demonstrates safe practices when working on steering systems	2	
Part 2	**Steering Design** ☐ identifies common steering system designs and their application ☐ lists advantages and disadvantages of individual designs ☐ identifies components of common steering system and their function ☐ describes the evolution of steering systems	2	
Part 3	**Driving Symptoms** ☐ lists driving symptoms of worn or defective steering components ☐ indicates factors that cause premature steering failure	2	
Part 4	**Service and Repair** ☐ identifies worn or defective components ☐ explains procedures for service/repair of components ☐ removes and replaces steering components	2	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Metal Repair & Finishing MEC2170-1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop/lab procedures ☐ selects and uses welding and sheet metal straightening system equipment	2	______
Part 2	**Major Sheet Metal Damage** ☐ describes direct and indirect collision damage ☐ describes buckles ☐ describes forces created by direct and indirect damage	2	______
Part 3	**Major Sheet Metal Repair on a Given Project** ☐ analyzes and determines sequence of repair ☐ performs metal straightening ☐ performs metal working ☐ performs a large rust out repair	2	______

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Trim Replacement MEC2180–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Safety** ☐ follows shop/lab procedures with respect to use of tools and supplies	2	
Part 2	**Trim Systems** ☐ describes interior/exterior trim materials ☐ describes window/door lock hardware function and part arrangement ☐ lists and describes fasteners used on interior and exterior trim	2	
Part 3	**Removal and Replacement of Trim** ☐ selects and uses appropriate trim tools ☐ removes and installs interior door trim as instructed ☐ removes and installs exterior trim as instructed	2	
Part 4	**Enhancement Trim** ☐ analyzes vehicle and proposes enhancement trim products and designs ☐ applies new trim, accessories, decals and/or vinyl overlays	2	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

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TASK ASSESSMENT CHECKLIST: Surface Preparation 2	**MEC2190–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses appropriate tools, equipment and materials ☐ recognizes and controls hazards involved in surface preparation through sand blasting, chemical treatment and abrasives ☐ uses proper personal protective equipment	2	______
Part 2	**Materials and Practices** ☐ lists metals/conditions and appropriate treatments ☐ lists plastics and preparation techniques ☐ lists and describes chemical use in surface preparation ☐ lists and identifies abrasive use in surface preparation ☐ lists chemical treatments and describes application	2	______
Part 3	**Advanced Preparation on a Given Surface** ☐ analyzes and determines preparation process ☐ selects and uses chemical application ☐ selects and applies coatings ☐ selects and compounds a surface	2	______

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
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1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Surface Preparation 2 MEC2190-2

Module Learner Expectation:	*The student will:* • carry out an advanced surface preparation.

Assessment Components	Details	Tolerance
Sanding	• selection of abrasives • sanding steps taken • sanding procedure	• finished results match the refinishing system to be utilized
Cleaning and Treating Bare Metal	• selection and use of bare metal treatment products to match the task	• results provide a surface ready for compounding or undercoating
Compounding Surface	• selection and procedure match the process (hand or machine)	• results provide surface for undercoating
Masking	• neatness and cleanliness	• no over mask areas, 2 - 3 under mask areas permitted
	• front-to-rear masking • side masking	• maximum – 1 joint
	• effective use of materials	• minimum wastage
	• correct use of plastic covering	

TASK ASSESSMENT CHECKLIST: Refinishing 1 MEC2200–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ identifies health hazards involved in refinishing ☐ uses proper personal protective equipment ☐ uses related WHMIS data	2	____
Part 2	**Products and Equipment** ☐ identifies and describes spray systems ☐ explains spray techniques ☐ lists spray problems and causes ☐ describes top coat application techniques	2	____
Part 3	**Refinish Application** ☐ selects and uses paints (including reducers/hardener) for a given application ☐ demonstrates spray procedures/techniques ☐ demonstrates clean-up/care of spray equipment ☐ identifies spray problems and corrects	2	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

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1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Touch-up & Finishing MEC2210–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures ☐ selects and uses appropriate tools, equipment and materials ☐ identifies health hazards related to touch-up and finishing including disposal of products ☐ identifies and controls health hazards associated with primers and putties	2	______
Part 2	**Techniques and Products** ☐ lists and describes products used in spot repair ☐ lists and describes techniques used in spot repair ☐ lists tools and equipment required for spot repair	2	______
Part 3	**Spot Repair** ☐ analyzes a given repair and outlines repair procedure ☐ prepares spot repair for painting ☐ selects paint by colour code to match existing colour ☐ applies paint to spot repair	2	______

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Interior Finishes & Repairs MEC2220–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 2 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows established shop/lab procedures in protection of people and vehicles ☐ lists and follows proper handling procedures for volatile chemicals ☐ stores and disposes chemicals as instructed ☐ uses proper personal protective equipment	2	______
Part 2	**Techniques and Products** ☐ identifies materials and describes repair procedure ☐ lists products and procedures to restore interior surface ☐ lists tools/equipment required for repairs	2	______
Part 3	**Clean and Repair** ☐ outlines procedures to restore a given interior surface ☐ selects tools/equipment and materials for repair ☐ repairs a minor interior surface problem ☐ cleans an interior surface	2	______

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Buying & Selling Vehicles MEC3010–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Determining Vehicle** ☐ predetermines criteria for choosing a vehicle ☐ selects and states why a particular vehicle is chosen ☐ states how vehicle meets financial, emotional, service constraints	3	
Part 2	**Evaluating Selected Vehicle** ☐ inspects vehicle systems/components to determine its worth ☐ compares inspection data to predetermined constraints ☐ evaluates whether purchase would be within predetermined constraints	3	
Part 3	**Buying and Selling** ☐ outlines steps in selling or buying a vehicle ☐ lists steps involved in determining a selling price for a vehicle ☐ develops an advertisement for a vehicle	3	
Part 4	**Legal Responsibilities** ☐ identifies legal responsibilities and implications when buying a vehicle ☐ identifies legal responsibilities and implications when selling a vehicle	3	
Part 5	**Safety** ☐ outlines safety concerns when purchasing a vehicle ☐ outlines safety concerns when selling a vehicle ☐ completes a safety checklist	3	

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Vehicle Value Appraisal MEC3020–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Safety** ☐ follows shop/lab routines ☐ completes inspections in a safe manner	3	
Part 2	**Inspecting Vehicle Condition** ☐ inspects all vehicle systems ☐ collects data and reports service/repair requirement ☐ estimates cost of required service/repair	3	
Part 3	**Industry Estimating Standards** ☐ describes estimating standards used by industry ☐ identifies problems when estimating to industry standards ☐ reports on the true market value of a vehicle	3	
Part 4	**Conflicts** ☐ outlines business practice when attempting to resolve conflicts related to estimations and evaluations	3	

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Engine Diagnosis MEC3030–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
Part 1	*The student:* **Engine Diagnosis (Without Tools)** ☐ evaluates engine performance using sense of touch, hearing and sight (no diagnostic tools)	3	____
Part 2	**Engine Diagnosis (With Tools)** ☐ selects and uses the appropriate diagnostic tools and equipment to diagnose the condition of: – mechanical system – ignition system – cooling/exhaust system – fuel system – emission control system	3	____
Part 3	**Report** ☐ interprets test results ☐ lists and provides rationale for areas requiring attention ☐ provides a cost analysis ☐ records test results	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Engine Diagnosis MEC3030–2

Module Learner Expectation:	*The student will:* • provide a report that describes the condition of an engine.

SAMPLE ITEM(S) ON REPORT	
Items Checked	**Condition**
Engine Mechanical Checks • dry and wet compression test readings for each cylinder • cylinder leakage test for each cylinder • vacuum test with tachometer – idle – acceleration, deceleration • cylinder power balance test • valve adjustment Battery Test Checks • hydrometer • load test • three-minute charge test • cranking voltage test Starting System Checks • cranking current test • insulated/ground circuit Charging System Checks • alternator output test • voltage regulation test • insulated/ground circuit resistance checks Ignition System (oscilloscope check) • point ignition – dwell, point gap/condition, primary voltages • electronic ignition (follow manufacturers recommendations) • secondary ignition – coil output/polarity, distributor cap, rotor, secondary, wires, spark plugs condition, spark timing/advance Fuel System Checks • fuel pump pressure/capacity test • carburetor functions test • fuel injection power balance test Emission Control Check • PVC, ECS, EGR, AIR, computer controlled emission system, exhaust emission check	

TASK ASSESSMENT CHECKLIST: Engine Tune-up MEC3040–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Engine Mechanical** ☐ establishes a diagnostic sequence ☐ selects and uses appropriate equipment and resources ☐ performs mechanical condition test ☐ interprets data, establishes condition of engine	3	——
Part 2	**Fuel System** ☐ establishes diagnostic sequence ☐ selects and uses diagnostic equipment ☐ analyzes data and determines service requirements ☐ services carbureted system ☐ services a fuel injected system	3	——
Part 3	**Electrical, Emission, Exhaust** ☐ establishes diagnostic sequence ☐ selects and uses equipment to diagnose ignition, starting and charging system ☐ selects and uses equipment to diagnose emission and exhaust system ☐ analyzes data and determines service requirements ☐ services ignition, starting and charging systems ☐ services emission control and exhaust system	3	——

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Engine Tune-up MEC3040–2

SAMPLE ITEM(S) SERVICED DURING TUNE UP	
Part 1: MLE	Determine Engine Mechanical Condition • check engine compression pressures • check and correct engine manifold vacuum readings • check and adjust valve clearances
Part 2: MLE	Check and Service Carburetor/Fuel Injection System • check and change filters • check fuel pump pressure/capacity and correct • check, adjust and clean carburetor • check, clean and/or replace fuel injectors
Part 3: MLE	Use Diagnostic Equipment to Check, Interpret and Service Ignition, Charging, Starting, Emission Control and Exhaust System • check and adjust belt(s) tension • check and/or replace hoses • check and service battery/cables • check and correct alternator output and voltage • check and correct starter current draw and circuit voltage drops • check, clean or replace emission control system components (PCV, AIR, EEC, EGR, catalytic converter) • check and correct exhaust system • other - engine compartment fluids for condition and level, tires and any other items specified in service schedule

SERVICE REQUIREMENTS	
Mechanical System	
Fuel System	
Electrical and Emission Control System	

TASK ASSESSMENT CHECKLIST: Engine Replacement MEC3050–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module conditions and criteria.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Pre-Engine Removal** ☐ follows prescribed environmental precautions ☐ prepares for storage of components and fasteners ☐ uses resources to determine techniques and procedures	3	____
Part 2	**Engine Accessories** ☐ establishes a method of determining how to replace hoses, lines wires, clips, brackets, etc., in their respective locations ☐ removes and replaces accessories and related components	3	____
Part 3	**Engine Removal/Replacement** ☐ follows manufacturer's recommendations for proper lifting/ dropping points on an engine (including fastener precautions) ☐ follows recommended procedures for removing and installing engine ☐ re-establishes all components including proper torques, routing, alignment, etc.	3	____
Part 4	**Post Installation** ☐ installs necessary fluids ☐ makes appropriate adjustments prior to start-up ☐ performs start-up and engine run in procedures ☐ makes final adjustments/corrections before customer delivery	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Engine Replacement MEC3050–2

Module Learner Expectation:

The student will:
- identify steps involved to prepare a vehicle for engine removal.

SAMPLE ITEM(S)

STEPS REQUIRED BEFORE ENGINE REMOVAL

- Determine reason for engine removal (many tasks can be done with engine in chassis).
- Determine location of vehicle allowing for sufficient work space.
- Determine if engine will be removed with or without transmission.
- Determine protection required for painted surfaces.
- Scribe hood hinges.
- Drain engine oil and coolant.
- Disconnect and storage of battery.
- Disconnect and marking all wires, vacuum hoses.
- Remove radiator hoses, radiator and fan.
- Remove drive belts, air cleaner, accessories and any other item(s) preventing removal of engine.
- Determine where to install engine sling, fasteners to use and torque required for sling bolts.
- Use engine hoist, remove weight of engine from chassis.
- Determine whether to remove engine mounts from chassis or engine.
- Determine if transmission is left in:
  - support transmission if removed
  - drain fluid, remove axle shafts/driveshaft
  - speedometer cable.
- If standard transmission, remove clutch linkage/cable/hose.
- Determine how to store fasteners/components.

TASK ASSESSMENT CHECKLIST: Cylinder Head Reconditioning MEC3060–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
	The student:		
Part 1	**Cylinder Head Diagnoses & Removal** ☐ selects and uses diagnostic tools to perform checks before disassembly ☐ interprets data and indicates possible faults	3	____
Part 2	**Cylinder Head Service** ☐ disassembles, cleans and stores cylinder head and components ☐ performs necessary measurements/checks ☐ interprets data and determines service required ☐ performs valve, valve seat and guide service ☐ assembles cylinder head, checks and adjusts valve spring heights to manufacturers recommendations ☐ checks/services cylinder head related components	3	____
Part 3	**Cylinder Head Removal/Installation** ☐ removes cylinder head and related components ☐ prepares, organizes and stores components ☐ installs cylinder head and related components ☐ makes adjustments before start-up	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

BEST COPY AVAILABLE

Module Learner Expectations

The student will:
- recondition a cylinder head and its related components.

SAMPLE ITEM(S)
WHEN RECONDITIONING CYLINDER HEADS AND RELATED COMPONENTS

Cylinder head work will vary depending on the length of service, cast iron or aluminium, whether overhead cam or not. It is important that a thorough analysis be done to determine the extent of the reconditioning. The following sample list represents a complete reconditioning of cylinder head.

- Head Assembly:
  - Heads are easier to work on if cleaned before disassembly, and face protection should be worn when removing valve springs.
  - Items such as valves, springs, retainers, rocker arms, lifters, push rods, camshaft bearing caps, journals must be kept in their original order.
    - Using valve spring compressor, remove valve springs.
    - Measure valve stem height, record and remove valve.
- Carbon Removal:
  - Several methods maybe used to remove carbon, such as portable wire wheel/brush scrapers and/or glass bead. Cleaning all surfaces including guides.
- Crack Inspection:
  - Several methods are available such as visual, magnetic dye penetrate or pressure testing.
- Warpage Inspection:
  - Using straight edge and feeler gauge, check warped or bent cylinder head deck.
- Valve Guides Inspection:
  - Several methods can be used including dial indicator, small hole gauge and micrometer. Check for maximum clearance, which generally occurs near the top or bottom of the guide. Record readings.
- Valve Inspection:
  - Measure valve stem wear with a micrometer and record readings.
- Valve Guide Repair:
  - If clearances are excessive, clearances can be restored in several ways - replaceable guides replaced, integral guides reamed and inserts installed or valves replaced with oversized stems or guides knurled.
- Grinding Valves:
  - Grind valve face to specified angle and check if sufficient valve margin exists. Grind valve stem tip and chamfer.
- Grinding or Cutting Valve Seats:
  - Grind to specified angle and check valve face to seat contract and adjust to recommended position and seat width.
  - NOTE: Valve seats may require replacement.
- Assemble Cylinder Head:
  - Clean head thoroughly, lubricate valve stems, install new valve stem guide seal and assemble valves in head. Check and adjust assembled valve spring height.

Related Components:
- Camshaft:
  - Check for straightness, lobe wear/condition, journal size and wear.
- Camshaft Bearings:
  - Wear and size.
- Lifters:
  - Base condition, bore clearance, if hydraulic, leak down rate.
- Push Rods:
  - Straightness, end wear.
- Rocker Arms and Shaft:
  - Clearance and bore wear, push rod end and valve stem end wear (maybe machined on some rocker arms).
- Camshaft Chain/Sprockets/Gears:
  - Checked for wear.
- Timing Belt:
  - Checked for wear, consult manufacturers recommendations for replacement.
- Manifolds:
  - Check for cracks, warpage, coolant/air passages, carbon build-up, good machined surfaces.

ILLUSTRATIVE EXAMPLE: Cylinder Head Assembly Measurement MEC3060–3

Module Learner Expectation: *The student will:*

- recondition a cylinder head and its related components.

Measurement appraisal using: steel rule, straight edge, feeler gauges, calipers, depth gauge and outside micrometer

	Cylinder Head Warpage	Valve Margin	Stem Diameter	Guide Diameter	Stem To Guide Clearance	Seat Width	Valve Spring Assembled Height	Valve Stem Assembled Height
Manufacturers Specifications:								
Valve #1								
Valve #2								
Valve #3								
Valve #4								
Valve #5								
Valve #6								
Valve #7								
Valve #8								
Minimum standard for measuring accuracy	± .001 inches or ± .025 mm	± .015 inches or ± .4 mm	± .001 inches or ± .025 mm	± .001 inches or ± .025 mm	± .001 inches or ± .025 mm	± .015 inches or ± .4 mm	± .001 inches or ± .025 mm	± .001 inches or ± .025 mm

From the above measurements, students would make a decision regarding part replacement or further service.

The above chart can be expanded to adapt to engines with more valves.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Cylinder Block Reconditioning MEC3070–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Cylinder Block Inspection/Diagnosis** ☐ selects and uses appropriate diagnostic tools to inspect cylinders, pistons, rods, crankshaft, camshaft, bearings and related components ☐ interprets data and develops plan of action for service ☐ creates a cost estimate and timeline for service	3	____
Part 2	**Cylinder Block Service** ☐ services cylinder block ☐ services piston rod assembly ☐ services crankshaft/camshaft (if applicable) ☐ services related components (oil pump, crankshaft balancer)	3	____
Part 3	**Cylinder Block Disassembly/Assembly** ☐ disassembles cylinder block observing precautions for reassembly ☐ prepares, organizes and stores components ☐ assembles cylinder block and related components to manufacturers recommendations	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Cylinder Block Reconditioning MEC3070–2

Module Learner Expectation:	*The student will:* • recondition a cylinder block and its related components.

Note: Cylinder block inspection, service and repair will depend on type of cylinder block. For this module learner expectation, cylinder rebore is not included.

SAMPLE ITEM(S)

FOR CYLINDER BLOCK RECONDITIONING

CYLINDER BLOCK

- Decking of the Block:
  - Draw file the decking surfaces. With straight edge and feeler gauges, check for warpage and cracks.
- Cylinder Bore:
  - Check cylinder bore for taper, out-of-roundness and size (maximum wear 90° to piston pin). Check the cylinder bore for cracks, excessive scuffing or scratches.
  - If cylinder bore checks indicate reuse of block - make certain ring ridge is removed and cylinders are de-glazed (if recommended)
- Lifter Bores:
  - Check size and cleanliness of oil passages.
- Oil Galleries and Coolant Passage:
  - Check for cleanliness and tight plugs.
- Cam Bearings/Bore:
  - Check condition, size and replace if necessary
- Crankshaft:
  - Check for bends, cracks, clear oil passages. Journals are checked for condition, size, taper and out of roundness. If crankshaft does not check-out, it must be reground or polished.
- Pistons:
  - Piston skirts are checked for scuffing, size and taper. If not within manufacturers specifications, replace.
- Piston Grooves:
  - Checked for wear and side clearance (if excessive wear, groove inserts maybe installed).
- Piston Pins:
  - Check for clearance between pin and pin boss (if excessive, oversized pins maybe installed). If equipped with retainers, retainers are checked.
- Connecting Rods:
  - Checked for cracks, twists and bends, large ends are checked for out-of-roundness, taper and size. (If not within specifications, maybe resized. Small end, depending on type (press fit or full floating) checked for size and re-machined/bushed if necessary.)
- Camshaft (if not an overhead valve engine):
  - Check for straightness, lobe condition/lift, journal size, taper and condition.
- Related Components:
  - Check camshaft, chain, sprocket, gears for wear. Check out oil pump internal components for wear/clearances including pressure relief valve, driveshaft, screen, oil pan including plug, windage tray/baffles.

ILLUSTRATIVE EXAMPLE: Piston and Cylinder Measurement MEC3070–3

Module Learner Expectation:	*The student will:* • recondition a cylinder block and its related components.

Measurement appraisal of pistons and cylinders using straight edge, feeler gauges, cylinder gauge, outside/ inside micrometers and telescopic gauges.

	PISTONS								CYLINDERS					
	Piston Ring Groove Width	Ring Side Clearance	Piston Ring Gap		Piston		Piston Pin Diameter	Pin to Boss Clearance (floating pin)	Deck Warpage	Cylinder Bore Condition	Bore Size	Bore		
			Top	Bottom	Size	Taper						Out-of-roundness	Taper	Piston to Bore Clearance
Manufacturer's Specifications														
Piston/Cylinder #1														
Piston/Cylinder #2														
Piston/Cylinder #3														
Piston/Cylinder #4														

Minimum standard for measuring accuracy: ± .001" or ± .025 mm

From the above measurements, students would make a decision regarding part replacement or further service.

The above chart can be expanded to adapt to engines with more cylinders.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Crankshaft and Main Bearing Measurement MEC3070–4

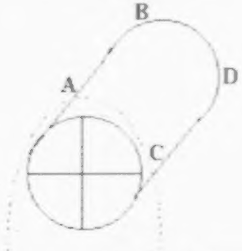
Module Learner Expectation:	*The student will:* • recondition a cylinder block and its related components.

	CRANKSHAFT												CYLINDER BLOCK			
	Conrod Journal Sizes						Main Journal Sizes						Block Main Bearing Bore			
													Bore			
	A	B	C	D	Taper	Out-of Roundness	A	B	C	D	Taper	Out-of Roundness	Size	Taper	Out-of Roundness	Straightness
Manufacturer's Specifications																
Journal #1																
Journal #2																
Journal #3																
Journal #4																

Minimum standard for measuring accuracy

± 0.0005 inches or ± 0.0125 mm

± 0.001 or 0.025 mm



crankshaft journal measuring reference

From the above obtained measurements, students would make discussions regarding part replacement or further service.

The above chart would be expanded to adapt to engines with more cylinders.

RELFECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Alternate Energy Systems MEC3080–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Historical Development** ☐ reports on historical developments of internal combustion engines including manufacturing techniques	3	____
Part 2	**Engine Design** ☐ reports on types of engine designs using alternate fuel and alternate engine designs using conventional fuel ☐ reports on developments in electric powered vehicles	3	____
Part 3	**Future Developments** ☐ reports on possible areas of future developments in alternative propulsion systems	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Computer Systems MEC3090–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Computer Management System** ☐ identifies common principles of computer management systems ☐ identifies and compares input and output devices used on vehicles with that of PCs	3	___
Part 2	**Components** ☐ locates CPU and input/output devices ☐ describes the relationship of the CPU and its related components	3	___
Part 3	**Computer Management Operation** ☐ describes what and how information is gathered and processed ☐ describes how changed inputs affect outputs	3	___
Part 4	**Service and Repair** ☐ selects and uses proper diagnostic equipment to diagnose management system ☐ repairs/replaces components and evaluates system	3	___

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Safety Systems MEC3100–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Safety Systems** ☐ identifies need for safety systems ☐ lists and describes the evolution of safety systems in vehicles ☐ describes possible future developments in safety systems	3	____
Part 2	**Service and Repair** ☐ selects and uses proper equipment to diagnose safety systems ☐ services and repairs safety systems to manufacturer's recommendations	3	____

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Climate Control MEC3110–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Climate Control Systems** ☐ identifies parts/components of a heater system ☐ identifies parts/components of air conditioning system ☐ describes the function and operation of a heater and air conditioning system ☐ describes how control systems combine functions to provide hot and cold air	3	____
Part 2	**Diagnosis, Service and Repair** ☐ selects and uses tools to diagnose climate control systems according to manufacturer's recommendations ☐ services and repairs climate control systems to manufacturer's recommendations	3	____
Part 3	**Environmental Concerns** ☐ states the effects of refrigerants on the ecosystem ☐ identifies environmental laws affecting climate control service ☐ identifies alternate refrigerants indicating advantages and disadvantages	3	____

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Power Assisting MEC3120–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		**Standard**	**Observed Rating**
	The student:		
Part 1	**Power Assist Components** ☐ identifies power assist systems. ☐ identifies components of power assist system ☐ outlines purpose and rationale for using power assist equipment	3	____
Part 2	**Pneumatic System** ☐ selects and uses tools to diagnose pneumatic power assist system ☐ selects and uses tools to service/repair pneumatic system/components to manufacturer's recommendations	3	____
Part 3	**Hydraulic System** ☐ selects and uses tools to diagnose a hydraulic power assist system ☐ selects and uses tools to service/repair hydraulic system to manufacturer's recommendations	3	____
Part 4	**Electrical System** ☐ selects and uses tools to diagnose a electrical power assist system ☐ selects and uses tools to service/repair electrical system to manufacturer's recommendations	3	____

Rating Scale:

4	Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*
3	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*
2	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*
1	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*
0	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Automatic Transmissions MEC3130–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Components and Function** ☐ identifies components ☐ traces power flow through clutches/bands in various gear selector positions ☐ explains how shifting is accomplished	3	____
Part 2	**Inspection/Service/Repair** ☐ selects and uses tools to diagnose faults ☐ analyzes and reports on condition of transmission ☐ changes transmission fluid and filter ☐ adjusts linkage/bands ☐ removes and replaces a transmission ☐ make minor repairs to an automatic transmission	3	____

Rating Scale: **4** Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.* **3** Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent. Works cooperatively and contributes ideas and suggestions that enhance team effort. Analyzes and provides effective client/customer services.* **2** Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively to achieve team goals. Identifies and provides customer/client services.* **1** Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent. Works cooperatively. Provides a limited range of customer/client services.* **0** Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.	***REFLECTIONS/COMMENTS:***

TASK ASSESSMENT CHECKLIST: Drive Train Repair	MEC3140–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Clutches** ☐ inspects clutch performance ☐ replaces clutch plate/pressure plate and related components following manufacturer's recommendations ☐ makes post-installation checks and adjustments	3	____
Part 2	**Standard Transmission** ☐ inspects and determines condition of transmission ☐ removes and replaces a transmission ☐ disassembles and reassembles transmission ☐ on a disassembled transmission, makes inspection/checks and required service/repair	3	____
Part 3	**Differential** ☐ inspects and determines condition of differential ☐ selects and uses tools to inspect and adjust a differential		
Part 4	**Drive Axle Assembly** ☐ selects and uses tools to inspect drive axles ☐ removes and replaces drive axles ☐ removes and replaces universal joint(s)	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards.*

3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively. *Quality and productivity are consistent.*

2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately. *Quality and productivity are reasonably consistent.*

1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately. *Quality and productivity are reasonably consistent.*

0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Wheel Alignment MEC3150–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Prealignment** ☐ determines customer need ☐ determines condition of steering components and repair ☐ determines condition of suspension components and repair ☐ analyzes tire wear patterns	3	____
Part 2	**Alignment Angles** ☐ identifies six alignment angles (including negative and positive where applicable) ☐ identifies angle adjustment methods and procedures ☐ indicates affects of incorrect angles on vehicle handling and components	3	____
Part 3	**Alignment Equipment** ☐ follows accepted alignment equipment use ☐ measures alignment angles on a specified vehicle ☐ interprets data, compares to specifications and determines required service ☐ adjusts angles to specifications	3	____
Part 4	**Post Alignment** ☐ contrasts driving symptoms to prealignment conditions ☐ assesses work performed, condition of vehicle, readiness for customer delivery ☐ reports vehicle status to customer	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Wheel Alignment MEC3150–2

Module Learner Expectation:	*The student will:* • identify measurements and angles used to check and adjust suspension and steering systems.

Note: Alignment angle measurement and adjustment depend on suspension and steering system incorporated in a vehicle.

SAMPLE ITEM(S)
FOR IDENTIFICATION OF ALIGNMENT ANGLES

- Give examples of wheel alignment angles:
  - camber (positive and negative)
  - caster (positive and negative)
  - toe (toe-in and toe-out)
  - steering axis inclination
  - toe-out on turns
  - tracking
- Make the following angle adjustments:
  - camber and caster when vehicle equipped with control arms:
    - shims between control arm and frame
    - slots for bolts between control arm and frame
    - eccentric bolt and cam on control arm
    - ball joint eccentric
    - strut rod—lower control arm (caster only)
  - camber and caster when vehicle equipped with struts:
    - slots in upper strut mount
    - eccentric bolt on spindle mount (camber only)
  - toe in or out
- Angle Adjustment Sequence:
  - caster, camber and toe-in
- Explain the effects of incorrect alignment angles on vehicle
  - Camber— tire shoulder wear, ball joint, wheel bearing wear, pulls to the side with most positive or least negative camber
  - Caster— excessive positive steering, hard steering, excessive road shock, wheel shimmy, pulls to the side with the least positive caster and excessive negative— wander and instability, pulls to the side with the most negative caster
  - Steering axis inclination— instability, poor steering wheel recovery to centre position, pulls to side with the least angle
  - Toe—tire wear
  - Toe-out-on-turns— tire wear and squeal on turns
  - Tracking— steering wheel off centre, wander

Note: Defective brakes, tires, suspension and steering components will also affect steering.

TASK ASSESSMENT CHECKLIST: Body Repair Estimation MEC3160–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Estimating and Legal Obligations** ☐ defines insurance, liability, waiver, write-off premium and deductible ☐ describes legal implications when estimating	3	____
Part 2	**Investigation, Vehicle Construction, Part Costs** ☐ selects and uses resources ☐ identifies problem-solving approach to collision damage ☐ identifies direct and hidden collision damage ☐ identifies accessory parts ☐ sources parts and prices (including original equipment manufacturer and aftermarket)	3	____
Part 3	**Estimating Procedures** ☐ lists the skills and knowledge required for estimating collision damage to include visual, measurement, calculation, product knowledge	3	____
Part 4	**Damage Estimate** ☐ applies knowledge and skills in estimating a given collision damage ☐ provides a cost analysis including part, labour, shop and miscellaneous costs ☐ provides a comparison between vehicle value and repair costs	3	____

Rating Scale:

4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence. *Quality, particularly details and finishes, and productivity are consistent and exceed standards. Leads others to contribute team goals. Analyzes and provides effective client/customer services beyond expectations.*

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Body Repair Estimation MEC3160–2

Module Learner Expectations

The student will: complete an estimate by determining what parts/components are to be replaced or repaired and their subsequent costs.

Damage Report on a Given Damaged Vehicle to Include:

- Zone 1:
  - Primary damage (near force of impact) to include:
    - grille, hood, fenders, quarter panels, deck lid, doors, pillars, roof, floor pans, bumper systems, component/structural supports, rails
- Zone 2:
  - Secondary damage (damage outside of Zone 1)
- Zone 3:
  - Mechanical damage to components such as:
    - radiator
    - fan
    - power steering pump
    - alternator
    - battery
    - air condition
    - reservoirs
    - engine
    - transmission
    - rear axle
    - driveshaft
    - steering
    - suspension
    - brake system
- Zone 4:
  - Passenger compartment damage to interior trim accessories including operation of all components
- Zone 5:
  - Exterior trim and finish

Estimating Parts, Labour and Miscellaneous Costs

- Use crash guides to determine labour and parts costs.
- Determining when component is repaired or replaced.
- Determining when salvage, aftermarket or original equipment manufacturer (OEM) parts are used.
- Determine the total cost of the repair.

Determining Vehicle Value Versus Repair Costs

- Determine actual vehicle cash value (ACV) using a used car guide.
- Determine whether vehicle should be repaired.

TASK ASSESSMENT CHECKLIST: Damage Analysis **MEC3170–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures including use of personal protective equipment ☐ selects and uses proper vehicle jacks and stands ☐ follows safe practices in part removal/replacement	3	____
Part 2	**Damage Types** ☐ recognizes vehicle construction safety features and its effects on collision damage ☐ recognizes frame types and effects of collision damage ☐ locates secondary and hidden damage ☐ describes methods used to determine damage	3	____
Part 3	**Measuring for Analysis** ☐ selects and uses measuring tools and equipment ☐ collects data and evaluates damage ☐ indicates relationship between suspension, alignment and collision damage	3	____
Part 4	**Repair Strategy** ☐ uses a repair estimate and prepares a repair strategy including procedures and proper sequence	3	____

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Damage Repair 1 MEC3180–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
	The student:		
Part 1	**Safety** ☐ follows shop safety procedures including use of proper personal protective equipment ☐ selects and uses power, welding and cutting tools	3	____
Part 2	**Removal/Replacement of Parts** ☐ analyzes part and determines repair sequence ☐ removes and installs parts and accessories as instructed ☐ prepares adjacent parts/surfaces for installation	3	____
Part 3	**Alignment/Preparation** ☐ determines correct alignment procedure ☐ aligns parts as per established procedures ☐ performs preparation of parts for painting	3	____
Part 4	**Trim Parts** ☐ determines cost effective repair method ☐ repairs or replaces trim parts as recommended	3	____

Rating Scale:

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REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Damage Repair 2 **MEC3190–1**

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures including use of proper personal protective equipment ☐ selects and uses power, hydraulic, welding and cutting equipment	3	____
Part 2	**Frame, Body Construction and Repair** ☐ explains frame construction ☐ explains unibody construction ☐ explains HSS/HSLA metals characteristics ☐ describes methods used to repair vehicle bodies	3	____
Part 3	**Frame/Body Straightener** ☐ demonstrates knowledge and use of measurement charts and parts terminology ☐ uses a bench frame straightening system to measure a chassis	3	____
Part 4	**Frame/Body Straightening Analysis** ☐ selects and uses resources to evaluate misalignment ☐ analyzes data and determines misalignment ☐ explains misalignment affects on suspension geometry		
Part 5	**Frame/Body Straightening** ☐ uses bench frame straightening system to correct alignment ☐ selects and uses jacks to align frame/body ☐ aligns and fabricates damaged parts	3	____
Part 6	**Suspension Alignment** ☐ identifies suspension problems owing to collision ☐ understands legal implications when repairing structural damage	3	____

Rating Scale:

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REFLECTIONS/COMMENTS:

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Module Learner Expectation:	***The student will:*** • **correct frame/body alignment involving replacement of unibody panels and use of hydraulic jacks and welders.**

Assessment Components	**Details**	**Indicator**
Welding/Cutting Panels	• cuts made as predetermined • welds correctly placed, spaced and with proper penetration	• full penetration with uniform beads
Straightening Process	• openings for doors, hood, deck and glass to prescribed sizes • vehicle tracking	• datum chart specifications • within manufacturers specifications

TASK ASSESSMENT CHECKLIST: Refinishing 2 MEC3200–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures and routines ☐ selects and uses auto body shop materials and safety equipment ☐ locates and follows instructions on WHIMIS data sheets	3	____
Part 2	**Top Coats, Solvents and Additives** ☐ identifies three widely used paint systems ☐ identifies and describes solvents and selection process ☐ identifies and explains additives and selection process	3	____
Part 3	**Refinish Application** ☐ applies an acrylic enamel paint system ☐ applies a base/clear coat paint system	3	____
Part 4	**Problem Solving** ☐ identifies and solves paint product and spray application problems ☐ identifies and solves refinishing equipment problems	3	____

Rating Scale:

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REFLECTIONS/COMMENTS:

ILLUSTRATIVE EXAMPLE: Refinishing 2 MEC3200–2

Module Learner Expectation: *The student will:*

- apply metallic, tutone and/or base/clear coat and acrylic enamel finishes.

Assessment Components	Details	Tolerance
Overspray	• evidence of wheel wells properly masked • door jams and body openings blocked for overspray	• no overspray
Painted Surface Condition	• evidence of runs, sages, dryspray and dirt	• minor evidence of two only
Detailing and Cleaning	• all components properly attached and adjusted • cleanliness • removal of overspray	• no evidence of overlooked areas
Paint Room and General Clean-up	• pain room clean-up • spray equipment cleaned with air cap in solvent • waste disposed	• no evidence of colour on exterior surfaces

TASK ASSESSMENT CHECKLIST: Plastic & Fibreglass MEC3210–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures and routines ☐ follows safe practices when working with plastics and fibreglass ☐ accesses and uses WHIMIS data	3	_____
Part 2	**Plastics** ☐ describes and determines types of plastics ☐ describes repairs methods available for plastics ☐ describes equipment/materials required to repair plastics	3	_____
Part 3	**Plastic Repair** ☐ performs a plastic weld ☐ performs a plastic bond	3	_____
Part 4	**Fibreglass** ☐ describes and determines types of fibreglass materials including resins and hardeners ☐ describes procedures for doing a repair	3	_____
Part 5	**Fibreglass Repair** ☐ performs a fibreglass repair method	3	_____

Rating Scale:

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0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

REFLECTIONS/COMMENTS:

TASK ASSESSMENT CHECKLIST: Glass Replacement MEC3220–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures and routines ☐ follows prescribed safety procedures when handling glass ☐ follows prescribed steps in disposing broken glass and glass products	3	___
Part 2	**Glass Technology** ☐ selects and uses glass resources and materials ☐ identifies glass types and function ☐ identifies glass retaining systems including moldings and seals	3	___
Part 3	**Glass Replacement Procedures** ☐ selects and uses resources for glass replacement ☐ identifies tools and procedures for glass replacement	3	___
Part 4	**Glass Replacement** ☐ removes and replaces front or rear glass ☐ removes and installs side glass ☐ seals and tests glass installation ☐ aligns door glass correctly	3	___

Rating Scale:

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REFLECTIONS/COMMENTS:

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TASK ASSESSMENT CHECKLIST: Refinishing 3 MEC3230–1

STANDARD:	Students working at STANDARD must demonstrate a performance rating of 3 as specified in module criteria and conditions.

TASK PERFORMANCE CRITERIA		Standard	Observed Rating
Part 1	*The student:* **Safety** ☐ follows shop safety procedures and routines ☐ selects and uses auto body shop materials and safety equipment ☐ locates and uses WHIMIS data sheets	3	_____
Part 2	**Refinish Technology** ☐ selects and uses refinish resources ☐ explains base and clear coat systems ☐ explains plastic coatings ☐ explains colour matching using colour code reference	3	_____
Part 3	**Refinish Application** ☐ explains applications of high tech paint systems ☐ applies tutone, striped or custom finishes ☐ cleans spray equipment and area ☐ disposes waste products following accepted practices	3	_____

Rating Scale:

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REFLECTIONS/COMMENTS:

MECHANICS

SECTION H: LINKAGES/TRANSITIONS

This section of the GSI has been designed to provide an overview of linkages and transitions of CTS modules with a number of organizations. The charts and information presented in this section will assist CTS students and teachers in understanding the potential application of CTS modules as students move into the workplace.

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LINKAGES/TRANSITIONS

There are many opportunities for students in Mechanics to build linkages among CTS strands and across other subject areas, including core and complementary programs. In addition to making linkages across the curriculum, making connections between what the students have already learned in other settings (e.g., home, community and workplace) can also be achieved through this strand.

LINKAGES

With Basic Competencies

The Mechanics strand supports the development and integration of the basic competencies related to personal and resource management, problem solving, safe work practices and social interactions throughout the introductory, intermediate and advanced modules. It is important that students develop these competencies because success in the workplace often depends more on these skills than on many of the technical or academic skills they possess.

With Other CTS Strands

There are direct and indirect linkages with most strands, particularly where there is a need to understand how to use and maintain equipment/ technology. The following chart represents linkages with other strands that may be of interest to Mechanics students.

Strand	Linkage
Agriculture	Landscape and Turf Management: maintenance and safety check on equipment Agriculture Technology: research applications of technology in agriculture production, processing or marketing
Career Transitions	Safety, job maintenance and workplace modules Use of project modules to enhance competencies related to Mechanics
Community Health	First Aid certification
Communications	Study of equipment and maintenance required in the communication/printing industry
Construction Technologies	Tool and machine maintenance
Design Studies	Appropriate and effective design solutions, particularly as they apply to the Modes & Mechanisms module
Electro-Technologies	Knowledge and skills that apply to vehicle electrical and electronic systems
Enterprise and Innovation	Student can identify opportunities and develop future plans related to ventures in the mechanics field
Fabrication Studies	Welding/cutting/heating processes used in mechanics, particularly in autobody restoration Application of sheet metal fabrication principles Application of principles in brake work and engine rebuilding
Financial Management	Recognizing the need and developing skills in financial management necessary for successful business in Mechanics field
Foods	The maintenance and service skills required for food-processing and preparation equipment
Forestry	Career opportunities related to servicing of forestry equipment
Fashion Design	Knowledge and skills required for vehicle upholstery
Information Processing	Application of software, use of various information processing tools and processes
Tourism	Research land, air and sea transportation vehicles used in tourism and related career opportunities

It is important to note that the project, practicum and safety modules from the Career Transitions strand may be combined with modules from Mechanics strand to provide increased opportunities for students to develop expertise and refine their competencies in a particular area of study such as:

- acquiring safety skills and credentials
- completing vehicle repair work
- enhancing specific mechanical skills
- expanding a module topic or theme.

Examples of CTR Project modules that have been developed as extension to existing modules are provided in this section.

Linkages between Mechanics modules and other strands and across the curriculum have also been identified. Refer to "Mechanics: Connections With Other CTS Strands and Mechanics Connections Across the Curriculum" in this section.

In addition, modules may be aligned according to the course emphasis and themes that run between modules and strands as outlined in "Mechanics: Junior High School Module Clusters."

For a summary of modules that can be combined with Mechanics from other strands, refer to "Mechanics: Extended Scope and Sequence."

With Practical Arts Courses

As of September 1997, modules in the Mechanics strand replace many existing practical arts junior and senior high programs. A detailed correlation of the Mechanics strand modules to the related practical arts courses can be found in this section (see "Mechanics: Correlations to Junior/Senior High school Practical Arts Courses").

TRANSITIONS

To The Community/Workplace

Competencies developed in Mechanics provide students with many of the entry level skills for trades and occupations in the workplace (see "Mechanics: Potential Linkages with Alberta's Apprenticeship Trades").

Information from the National Occupational Classification (NOC) for which Mechanics provides a foundation is provided in this section (see "Mechanics: Related Occupations"). According to this chart, 12 occupations require high school education, and there are 23 trades related to Mechanics.

To Related Post-secondary Programs

The themes and modules offered in Mechanics are consistent with many of the pre-employment and apprenticeship courses now being offered by post-secondary institutions.

A number of articulation agreements have been established with post-secondary institutions in Alberta. These agreements provide preferred entrance and/or advanced standing/credit for CTS students who have successfully completed designated modules. A current summary of articulation agreements in place that involve CTS modules is available through Alberta Education's web site at <http://ednet.edc.gov.ab.ca>. For further information regarding particular articulation agreements, contact the post-secondary institution and/or review its respective calendar.

CTS courses in Mechanics may also link with one or more of Alberta's Apprenticeship Training Programs; e.g., Automotive Service Technician, Auto Body Technician. Students who are employed as an apprentice in one of these trade areas and have successfully completed designated CTS modules may also qualify, upon the recommendation of their employer, for a portion of the in-school training component. A summary of articulation agreements established for specific apprenticeship trades (including a correlation to CTS modules) is available through Alberta Education's web site. Further information regarding apprenticeship linkages can be obtained by contacting Alberta Advanced Education and Career Development, Apprenticeship and Industry Training Division.

An outline of post-secondary institutions in Alberta currently offering programs related to Mechanics can be found in this section (see "Mechanics: Summary of Related Post-secondary Programs").

CREDENTIALLING

Students may earn partial or complete credentials recognized in the workplace and/or post-secondary institutions by demonstrating specified competencies within the CTS curriculum. The Mechanics strand, in conjunction with modules from the Career Transitions strand, provide opportunities for students to develop competencies related to:

- Emergency First Aid
- Power Engineering
- Transportation of Dangerous Goods.
- Workplace Hazardous Materials Information System

Further information regarding credentialling in Mechanics is provided in this section (see "Credentialling Opportunities in Mechanics") and the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 14).

MODULE CTR2110: PROJECT 2A – BRAKE PROJECT

Level: Intermediate

Theme: Career Extension

Prerequisite: MEC2110 Braking Systems [Mechanics Strand]

Module Description: Students, through projects, extend and enhance competencies developed in the Career Transitions strand or other Career and Technology Studies strands to contexts that are personally relevant.

Module Parameters: The student should have access to specialized brake tools/equipment and related resources.

Note: Customer work must be supervised and checked by a certified technician.

Students will extend their competencies in braking systems in order to link with the first period Automotive Service Technician Apprenticeship Program.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• propose, manage and assess a project	• a prepared project plan that includes: – purpose of the project – expectations to be met – resources, equipment and tools to be utilized – project timelines. *Assessment Tool* *CTR Project: Career Extensions Modules* *Standard* *Performance rating of 3 on each criteria*	10
• meet goals as defined within the project plan	• completion of a report reflecting condition of: – brake fluid – brake tubing/hoses – master cylinder, wheel cylinders, calipers – rotors, drums – linings/pads – brake hardware – emergency brake components. *Assessment Tool* *Assessment Framework: Presentations/Reports, CTSPRE* *Standard* *Performance rating of 2 on each criteria*	20

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MODULE CTR2110: PROJECT 2A – BRAKE PROJECT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• performance related to reconditioning/replacing: – tubing/hoses – master cylinder, wheel alignment, calipers – rotors, drums – linings/pads – brake hardware. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 2 on each criteria*	50
	• performance related to checks/adjustments of: – master cylinder – drum-lining clearances – park brakes – power brake – bleeding brakes. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 2 on each criteria*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

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MODULE CTR2110: PROJECT 2A – BRAKE PROJECT (continued)

Concept	Specific Learner Expectations	Notes
Health and Safety Hazards	*The student should:* • demonstrate knowledge of and follow safety procedures related to: – use of hones, brake lathe, brake tools – disassembling calipers, wheel cylinders, master cylinder – raising vehicles – brake fluid use.	Be aware of the dangers associated with the use of compressed air.
Inspect/Service	• identify required service manuals and other resources for a given vehicle • identify deficiencies/services related to: – brake fluid – brake tubing/hoses – master cylinder, wheel cylinders, calipers – rotor, drums – brake linings, pads – brake hardware – springs, retainers, struts, adjuster assembly, splash shield, backing plate – emergency brake components – wheel bearings • provide a report outlining work required to correct deficiencies • replace brake lines and hoses, observing proper routing and retaining clips/clamps if required • rebuild the following if required: – master cylinder – wheel cylinder – caliper • replace brake linings and disc pads if worn • resurface brake drums and rotors if required	Recognize conditions that dictate replacement, e.g., clearance pitting, damaged bleeders screw. **Note**: Turned drums and rotors must be within the stated tolerances.

MODULE CTR2110: PROJECT 2A – BRAKE PROJECT (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Inspect/Service (continued)	• assemble/install all brake components observing: – lubrication points – adjustments/checks related to: • master cylinder • lining to drum clearances • emergency brake adjustment – bleeding brake system	Procedure required when working the metering and proportioning valves.
	• after completed assembly: – check service and park brake operation – complete work order reflecting all parts, service performed and possible deficiencies that have been observed – prepare vehicle for customer pick-up.	Brake or non-brake related.

MODULE CTR3110: PROJECT 3A – STANDARD TRANSMISSION PROJECT

Level: Advanced

Theme: Career Extensions

Prerequisite:
MEC2130 Power Trains [Mechanics Strand]
MEC2140 Transmissions/Transaxles [Mechanics Strand]
MEC3140 Drive Train Repair [Mechanics Strand]

Module Description: Students, through projects, extend and enhance competencies developed in the Career Transitions strand or other Career and Technology Studies strands to contexts that are personally relevant.

Module Parameters: The student should have access to specialized transmission tools and related resources.

Note: Customer work must be supervised and checked by a certified technician.

Students will extend their competencies in standard transmission repair in order to link with the first period Automotive Service Technician Apprenticeship Program.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• propose, manage and assess a project	• a prepared project plan that includes: – purpose of the project – expectations to be met – resources and tools to be utilized – project timelines. *Assessment Tool* *CTR Project: Career Extensions Modules* *Standard* *Performance rating of 3 on each criteria*	10
• meet goals as defined within the project plan	• performance in disassembling a manual transmission, observing: – following prescribed procedure – accuracy of checks performed – correct diagnosis of faulty components. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	35

MODULE CTR3110: PROJECT 3A – STANDARD TRANSMISSION PROJECT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • performance in reassembling a manual transmission, observing: – following prescribed procedure – measuring end play/clearance of gears and synchronizers – ability to shift assembled transmissions into all gear ranges. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	55
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health and Safety Hazards	*The student should:* • demonstrate knowledge of and follow safety procedures related to: – use of tools – fluid disposal – lifting transmissions.	Be aware of potential strains owing to improper lifting techniques.

MODULE CTR3110: PROJECT 3A – STANDARD TRANSMISSION PROJECT (continued)

Concept	Specific Learner Expectations	Notes
Inspect/Service	*The student should:* • identify the type of transmission using ID tag and manual on a given manual transmission: – follow repair manual procedures – make clearance/end play checks – disassemble according to instructions – clean and inspect for worn/damaged components • provide a report outlining work required to restore transmission • identify cause(s) that create manual transmission failures • assemble manual transmission, replacing defective parts and establishing all end play and clearance measurements on assembled transmission: – check operation – complete work order to reflect all parts/service performed – list any related or unrelated deficiencies.	

MODULE CTR3120: PROJECT 3B – WHEEL ALIGNMENT PROJECT

Level: Advanced

Theme: Career Extensions

Prerequisite:
MEC2150 Suspension System [Mechanics Strand]
MEC2160 Steering System [Mechanics Strand]
MEC3150 Wheel Alignment [Mechanics Strand]

Module Description: Students, through projects, extend and enhance competencies developed in the Career Transitions strand or other Career and Technology Studies strands to contexts that are personally relevant.

Module Parameters: The student should have access to wheel alignment equipment/tools and related resources.

Note: Customer work must be supervised and checked by a certified technician.

Students will extend their competencies in wheel alignment in order to link with the first period Automotive Service Technician Apprenticeship Program.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
• propose, manage and assess a project	• a prepared project plan that includes: – purpose of the project – expectations to be met – resources and tools to be utilized – project timelines. *Assessment Tool* *CTR Project: Career Extensions Modules* *Standard* *Performance rating of 3 on each criteria*	10
• meet goals as defined within the project plan	• performance in determining steering/suspension deficiencies including: – tires, wheels and wheel bearings – loose, worn or bent parts – suspension heights – steering gear condition and adjustments. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	15

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MODULE CTR3120: PROJECT 3B – WHEEL ALIGNMENT PROJECT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:*	
	• performance in obtaining wheel alignment angles by observing: – readings within manufacturer's specifications – readings to reflect desired steering characteristics, including overcoming road crown – centred steering wheel/gear. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	25
	• performance in adjusting wheel alignment angles, observing: – readings within manufacturer's specifications – readings to reflect desired steering characteristics, including overcoming road crown – centred steering wheel/gear. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	35
	• performance in evaluating and correcting wheel alignment, including: – vehicle lead – steering wheel recovery (after turn) – centred steering wheel/gear – vibration – general handling. *Assessment Tool* *Assessment Guide: Customer Service, MECCSP* *Standard* *Performance rating of 3 on each criteria*	15

MODULE CTR3120: PROJECT 3B – WHEEL ALIGNMENT PROJECT (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • demonstrate basic competencies.	*Assessment of student achievement should be based on:* • observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Health and Safety Hazards	*The student should:* • demonstrate knowledge of and follow safety procedures related to wheel alignment, including: – safe use of alignment equipment – issues related to unsafe vehicle owing to work related to alignment.	Fasteners correctly torqued, cotterpin use.
Project Definitions	• identify project including – purpose of the project – expectations to be met including customer concerns – resources, equipment and tools to be utilized – project timelines.	
Inspect/Service	• evaluate vehicle components including: – tires, wheels and wheel bearings – loose, worn or bent parts – suspension height – steering gear condition and adjustments.	

MODULE CTR3120: PROJECT 3B – WHEEL ALIGNMENT PROJECT (continued)

Concept	Specific Learner Expectations	Notes
	The student should: • replace and/or adjust components prior to performing wheel alignment • identify and obtain the following alignment angles: – caster – camber – steering axes inclination – turning radius – toe-in, toe-out • adjust alignment angles to reflect the following: – readings within manufacturer's specifications – readings to reflect desired steering characteristics including overcoming road crown – centred steering wheel/gear • evaluate completed alignment to confirm desired characteristics with respect to: – vehicle lead – steering wheel recovery – centred steering wheel/gear – vibration – general handling • correct all noted deficiencies • prepare vehicle for delivery to customer including: – completion of work order – cleanliness of vehicle.	

LINKAGES – *Mechanics: Connections With Other CTS Strands*

Mechanics Modules	Other CTS Strands																				
	Agriculture	Career Transitions	Communication Technology	Community Health	Construction Technologies	Cosmetology Studies	Design Studies	Energy and Mines	Electro-Technologies	Enterprise and Innovation	Fashion Studies	Financial Management	Foods	Fabrication Studies	Forestry	Legal Studies	Logistics	Information Processing	Management and Marketing	Tourism Studies	Wildlife
Theme: Vehicle Design and Ownership																					
MEC1010: Modes & Mechanisms		■			▤		▤			▤				▤	▤			▤			
MEC1020: Vehicle Service & Care	▤	■							▤	▤								▤	▤		
MEC2010: Vehicle Detailing		■								▤								▤	▤		
MEC2020: Vehicle Maintenance	▤	■							▤	▤								▤	▤		
MEC3010: Buying & Selling Vehicles		■								▤		▤						▤	■		
MEC3020: Vehicle Value Appraisal		■								▤									▤		
Theme: Propulsion Systems																					
MEC1040: Engine Fundamentals	▤	■								▤					▤			▤			
MEC2030: Lubrication & Cooling		■								▤											
MEC2040: Fuel & Exhaust Systems		■						▤		▤											
MEC2050: Alternate Fuel Engines		■						■		▤											
MEC2060: Ignition Systems		■							▤	▤											
MEC2070: Emission Controls		■						▤	▤	▤											
MEC3030: Engine Diagnosis		■								▤								▤			
MEC3040: Engine Tune-up		■							▤	▤											
MEC3050: Engine Replacement		■								▤											
MEC3060: Engine Reconditioning 1		■								▤											
MEC3070: Engine Reconditioning 2		■								▤											
MEC3080: Alternate Energy Systems		■								▤									▤		
Theme: Guidance and Control Systems																					
MEC1090: Electrical Fundamentals	▤	■							■	▤					▤						
MEC1110: Pneumatics & Hydraulics	▤	■								▤					▤			▤			
MEC1130: Mechanical Systems		■								▤								▤			
MEC2090: Electrical Components	▤	■							▤	▤											
MEC2100: Power Assist Accessories		■							▤	▤											
MEC2110: Braking Systems		■								▤				■							
MEC2120: Hydraulic Accessories		■								▤											
MEC2130: Drive Trains		■								▤											
MEC2140: Transmissions/Transaxles		■								▤											
MEC3090: Computer Systems		■							■	▤											
MEC3100: Safety Systems		■							▤	▤									▤		
MEC3110: Climate Control		■								▤											
MEC3120: Power Assisting		■							▤	▤											
MEC3130: Automatic Transmissions		■								▤											
MEC3140: Drive Train Repair		■								▤											
Theme: Suspension and Structural Systems																					
MEC1150: Ride & Control Systems		■								▤								▤			
MEC1160: Structures & Materials		■						▤		▤								▤			
MEC1170: Metal Forming & Finishing		■								▤				■				▤			
MEC1190: Surface Preparation 1		■								▤				▤				▤			
MEC2150: Suspension Systems		■								▤											
MEC2160: Steering Systems		■								▤											
MEC2170: Metal Repair & Finishing		■								▤				■							
MEC2180: Trim Replacement		■								▤											
MEC2190: Surface Preparation 2		■								▤											
MEC2200: Refinishing 1		■								▤				▤							
MEC2210: Touch-up & Finishing		■								▤											
MEC2220: Interior Repairs		■								▤	■										
MEC3150: Wheel Alignment		■								▤											
MEC3160: Body Repair Estimation		■								▤											
MEC3170: Damage Analysis		■								▤											
MEC3180: Damage Repair 1		■								▤				▤							
MEC3190: Damage Repair 2		■								▤				▤							
MEC3200: Refinishing 2		■								▤				▤							
MEC3210: Plastic & Fibreglass		■								▤				▤							
MEC3220: Glass Replacement		■								▤											
MEC3230: Refinishing 3		■								▤				▤							

Provides many direct links with competencies in this strand. Students will reinforce, extend and apply a substantial number of knowledge and/or skill components in practical situations.	■
Provides some links with competencies developed in this strand, usually through the application of related technologies and/or processes.	▤

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LINKAGES – *Mechanics: Connections Across the Curriculum*

Across the Curriculum

Mechanics Modules	Junior High							Senior High											
	Language Arts	Social Studies	Mathematics	Science	Health & PLS	Physical Education	Fine Arts	English	Social Studies	Mathematics	Science (General)	Biology	Chemistry	Physics	CALM	Physical Education	Fine Arts	Social Sciences	Second Language
Theme: Vehicle Design and Ownership																			
MEC1010: Modes & Mechanisms	▤		▤	▤				▤		▤					▤		▤		
MEC1020: Vehicle Service & Care	▤		▤					▤		▤	▤				▤				
MEC2010: Vehicle Detailing	▤							▤							▤				
MEC2020: Vehicle Maintenance	▤		▤					▤		▤					▤				
MEC3010: Buying & Selling Vehicles	▤	▤	▤					▤		▤					▤				
MEC3020: Vehicle Value Appraisal			▤					▤		▤					▤				
Theme: Propulsion Systems																			
MEC1040: Engine Fundamentals	▤		▤	▤				▤		▤					▤				
MEC2030: Lubrication & Cooling										▤					▤				
MEC2040: Fuel & Exhaust Systems								▤							▤				
MEC2050: Alternate Fuel Engines								▤							▤				
MEC2060: Ignition Systems			▤					▤		▤					▤				
MEC2070: Emission Controls								▤							▤				
MEC3030: Engine Diagnosis								▤							▤				
MEC3040: Engine Tune-up															▤				
MEC3050: Engine Replacement															▤				
MEC3060: Engine Reconditioning 1								▤		▤					▤				
MEC3070: Engine Reconditioning 2										▤					▤				
MEC3080: Alternate Energy Systems								▤							▤				
Theme: Guidance and Control Systems																			
MEC1090: Electrical Fundamentals			▤	▤						▤	■			▤	▤				
MEC1110: Pneumatics & Hydraulics	▤			▤				▤			▤				▤				
MEC1130: Mechanical Systems	▤			▤				▤			▤			▤	▤				
MEC2090: Electrical Components				▤				▤			▤			▤	▤				
MEC2100: Power Assist Accessories								▤							▤				
MEC2110: Braking Systems			▤					▤			▤				▤				
MEC2120: Hydraulic Accessories								▤							▤				
MEC2130: Drive Trains								▤							▤				
MEC2140: Transmissions/Transaxles								▤							▤				
MEC3090: Computer Systems								▤							▤				
MEC3100: Safety Systems								▤							▤				
MEC3110: Climate Control								▤							▤				
MEC3120: Power Assisting															▤				
MEC3130: Automatic Transmissions								▤		▤					▤				
MEC3140: Drive Train Repair															▤				
Theme: Suspension and Structural Systems																			
MEC1150: Ride & Control Systems	▤														▤				
MEC1160: Structures & Materials	▤														▤				
MEC1170: Metal Forming & Finishing	▤														▤				
MEC1190: Surface Preparation	▤														▤				
MEC2150: Suspension Systems															▤				
MEC2160: Steering Systems								▤							▤				
MEC2170: Metal Repair & Finishing								▤							▤				
MEC2180: Trim Replacement								▤							▤				
MEC2190: Surface Preparation 2															▤				
MEC2200: Refinishing 1								▤							▤				
MEC2210: Touch-up & Finishing															▤				
MEC2220: Interior Repairs								▤							▤				
MEC3150: Wheel Alignment										▤					▤				
MEC3160: Body Repair Estimation								▤						▤	▤				
MEC3170: Damage Analysis								▤							▤				
MEC3180: Damage Repair 1															▤				
MEC3190: Damage Repair 2								▤							▤				
MEC3200: Refinishing 2								▤							▤				
MEC3210: Plastic & Fibreglass								▤							▤				
MEC3220: Glass Replacement								▤							▤				
MEC3230: Refinishing 3								▤							▤				

Provides many direct links with course content. Students will reinforce, extend and apply a substantial number of knowledge and/or skill components in practical contexts.	■
Provides some links with course content, usually through the application of related technologies and/or processes.	▤

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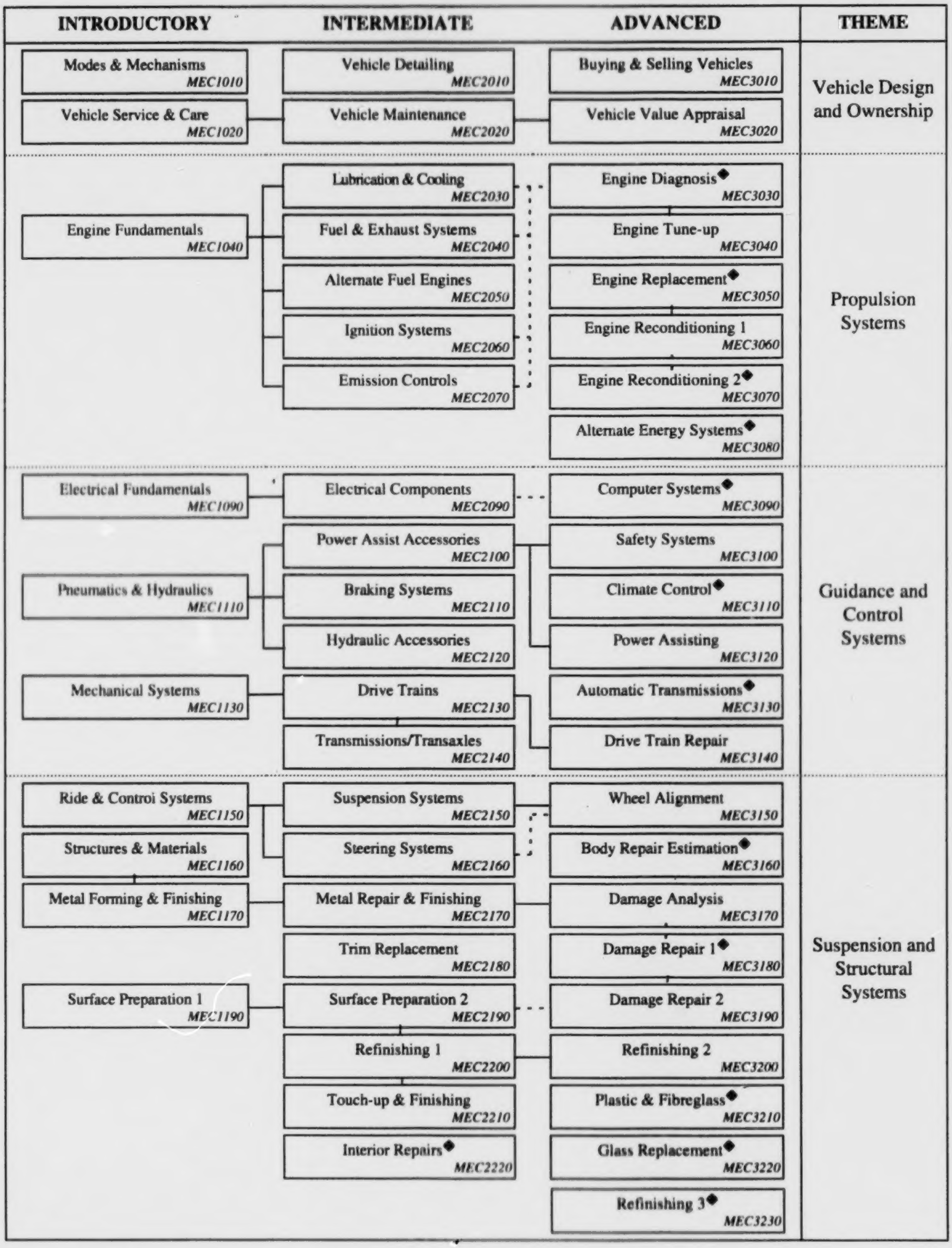
LINKAGES – *Mechanics: Junior High School Module Clusters*

Course Emphasis	Mechanics Modules	Electro-Technologies Modules	Communication Technology Modules	Design Studies Modules
Vehicle Ownership (3 modules)	Modes & Mechanisms *MEC1010* Vehicle Service & Care *MEC1020*	Electro-assembly 1 *ELT1010*		
Engine / Motors (4 modules)	Modes & Mechanisms *MEC1010* Vehicle Service & Care *MEC1020* Engine Fundamentals *MEC1040*	Electro-assembly 1 *ELT1010*		
Electricity / Electronics (5 modules)	Modes & Mechanisms *MEC1010* Electrical Fundamentals *MEC1090*	Electro-assembly 1 *ELT1010*		Sketch, Draw & Model *DES1010* The Design Process *DES1020*
Energy Conversion / Uses (6 modules)	Modes & Mechanisms *MEC1010*	Electro-assembly 1 *ELT1010*	Media & You *COM1020*	Sketch, Draw & Model *DES1010* The Design Process *DES1020*

Mechanics: *Scope and Sequence*



INTRODUCTORY	INTERMEDIATE	ADVANCED	THEME
Modes & Mechanisms *MEC1010*	Vehicle Detailing *MEC2010*	Buying & Selling Vehicles *MEC3010*	Vehicle Design and Ownership
Vehicle Service & Care *MEC1020*	Vehicle Maintenance *MEC2020*	Vehicle Value Appraisal *MEC3020*	
	Lubrication & Cooling *MEC2030*	Engine Diagnosis◆ *MEC3030*	Propulsion Systems
Engine Fundamentals *MEC1040*	Fuel & Exhaust Systems *MEC2040*	Engine Tune-up *MEC3040*	
	Alternate Fuel Engines *MEC2050*	Engine Replacement◆ *MEC3050*	
	Ignition Systems *MEC2060*	Engine Reconditioning 1 *MEC3060*	
	Emission Controls *MEC2070*	Engine Reconditioning 2◆ *MEC3070*	
		Alternate Energy Systems◆ *MEC3080*	
Electrical Fundamentals *MEC1090*	Electrical Components *MEC2090*	Computer Systems◆ *MEC3090*	Guidance and Control Systems
	Power Assist Accessories *MEC2100*	Safety Systems *MEC3100*	
Pneumatics & Hydraulics *MEC1110*	Braking Systems *MEC2110*	Climate Control◆ *MEC3110*	
	Hydraulic Accessories *MEC2120*	Power Assisting *MEC3120*	
Mechanical Systems *MEC1130*	Drive Trains *MEC2130*	Automatic Transmissions◆ *MEC3130*	
	Transmissions/Transaxles *MEC2140*	Drive Train Repair *MEC3140*	
Ride & Control Systems *MEC1150*	Suspension Systems *MEC2150*	Wheel Alignment *MEC3150*	Suspension and Structural Systems
Structures & Materials *MEC1160*	Steering Systems *MEC2160*	Body Repair Estimation◆ *MEC3160*	
Metal Forming & Finishing *MEC1170*	Metal Repair & Finishing *MEC2170*	Damage Analysis *MEC3170*	
	Trim Replacement *MEC2180*	Damage Repair 1◆ *MEC3180*	
Surface Preparation 1 *MEC1190*	Surface Preparation 2 *MEC2190*	Damage Repair 2 *MEC3190*	
	Refinishing 1 *MEC2200*	Refinishing 2 *MEC3200*	
	Touch-up & Finishing *MEC2210*	Plastic & Fibreglass◆ *MEC3210*	
	Interior Repairs◆ *MEC2220*	Glass Replacement◆ *MEC3220*	
		Refinishing 3◆ *MEC3230*	

——— Prerequisite . . . . Recommended sequence

◆Refer to specific modules for additional prerequisites.

Mechanics: *Extended Scope and Sequence*

THEME	INTRODUCTORY	INTERMEDIATE	ADVANCED
Vehicle Design and Ownership	You & the Law 1 *LGS1010*	Electrical Servicing *ELT2020*	Materials Testing *FAB3010*
	Consumer Products & Services *ENM1060*		
Propulsion Systems	Nonrenewable Resources *ENM1020*	Renewable Energy Technology *ENM2050*	
	Principles of Machining *FAB1130*	Precision Turning 1 *FAB2130*	Precision Turning 2 *FAB3130*
	Quality Customer Service *MAM1020*		
Guidance and Control Systems	Digital Technology 1 *ELT1060*	Digital Technology 2 *ELT2060*	Digital Technology 3 *ELT3060*
		Computer Technology *ELT2070*	Microprocessors *ELT3080*
	Control Systems 1 *ELT1080*	Control Systems 2 *ELT2080*	Microprocessor Interface *ELT3090*
Suspension and Structural Systems	Oxy-acetylene Welding *FAB1040*	Oxy-fuel Welding *FAB2030*	
	Basic Electric Welding *FAB1050*	Arc Welding 1 *FAB2050*	
	Sheet Fabrication 1 *FAB1090*	Arc Welding 2 *FAB2060*	Arc Welding 3 *FAB3050*
	Fabrication Principles *FAB1100*	Sheet Fabrication 2 *FAB2090*	Managing the Venture *EAI3010*
		Sheet Fabrication 3 *FAB2100*	Production Planning *CON3190*
		Upholstery *FAS2150*	Production Management *CON3200*

—— Prerequisite ····· Recommended sequence

Refer to specific modules for additional prerequisites and recommended sequence.

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LINKAGES - *MECHANICS: Correlation to Junior/Senior High Practical Arts Courses* *

Introductory, Intermediate and Advanced Modules	MEC1010: Modes & Mechanisms	MEC1020: Vehicle Service & Care	MEC1040: Engine Fundamentals	MEC1090: Electrical Fundamentals	MEC1110: Pneumatics & Hydraulics	MEC1130: Mechanical Systems	MEC1150: Ride & Control Systems	MEC1160: Structures & Materials	MEC1170: Metal Forming & Finishing	MEC1190: Surface Preparation 1	MEC2010: Vehicle Detailing	MEC2020: Vehicle Maintenance	MEC2030: Lubrication & Cooling	MEC2040: Fuel & Exhaust Systems	MEC2050: Alternate Fuel Engines	MEC2060: Ignition Systems	MEC2070: Emission Controls	MEC2090: Electrical Components	MEC2100: Power Assist Accessories	MEC2110: Braking Systems	MEC2120: Hydraulic Accessories	MEC2130: Drive Trains	MEC2140: Transmissions/Transaxles	MEC2150: Suspension Systems	MEC2160: Steering Systems	MEC2170: Metal Repair & Finishing	MEC2180: Trim Replacement	MEC2190: Surface Preparation 2	MEC2200: Refinishing 1	MEC2210: Touch-up & Finishing	MEC2220: Interior Repairs	MEC3010: Buying & Selling Vehicles	MEC3020: Vehicle Value Appraisal	MEC3030: Engine Diagnosis	MEC3040: Engine Tune-up	MEC3050: Engine Replacement	MEC3060: Engine Reconditioning 1	MEC3070: Engine Reconditioning 2	MEC3080: Alternate Energy Systems	MEC3090: Computer Systems	MEC3100: Safety Systems	MEC3110: Climate Control	MEC3120: Power Assisting	MEC3130: Automatic Transmissions	MEC3140: Drive Train Repair	MEC3150: Wheel Alignment	MEC3160: Body Repair Estimation	MEC3170: Damage Analysis	MEC3180: Damage Repair 1	MEC3190: Damage Repair 2	MEC3200: Refinishing 2	MEC3210: Plastic & Fibreglass	MEC3220: Glass Replacement	MEC3230: Refinishing 3
Junior High Power Mechanics	X		X		X	X																																																
Power Technology 10, 20, 30 (1 credit)																																																						
Conventional Heat Engines			X									X																																										
Small Engine Repair			X																																		X	X																
Small Engine Tune-up and Troubleshooting												X	X	X		X																		X	X																			
Mechanical Systems						X																X	X																															
Electrical and Electronic Systems				X														X	X																					X														
Automobile Maintenance		X									X	X	X																																									
Fluid Power					X															X	X																							X										
Automobile Tune-up																X	X																	X	X																			
Automobile Repair									X									X		X		X														X	X	X						X										
Automobile Ownership		X																														X																						
Vocational (5 credits)																																																						
Mechanics 12		X	X	X		X						X	X	X																																								
Automotives 22A					X															X				X	X																					X								
Automotives 22B						X																X	X																					X	X									
Automotives 22C				X								X				X		X	X																																			
Automotives 32A														X			X																	X	X																			
Automotives 32B			X										X	X	X	X																		X	X	X	X	X																
Automotives 32C	Career Transition - Project Module																																																					
Auto Body 12							X	X	X	X	X																																											
Auto Body 22A	Career Transition - Project Module																														X																		X					
Auto Body 22B																										X	X	X	X		X																	X						
Auto Body 22C	Career Transition - Project Module																																																X	X		X		
Auto Body 32A																																	X													X				X		X	
Auto Body 32B				X																											X																						X	X
Auto Body 32C	Career Transition - Project Module																																																					
Related Mechanics 22A			X										X	X		X																		X	X																			

* September 1997: All practical arts courses replaced by Career and Technology Studies.

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LINKAGES – *Mechanics: Potential Linkages With Alberta Apprenticeship Trades*

		CTS Strands												Enhancement Modules		
	Trade	Agriculture	Communication Technolog	Construction Technolog	Cosmetology	Design Studies	Electro-Technologies	Energy & Mines	Fabrication Studies	Fashion Studies	Foods	Management & Marketing	Mechanics	Career Transitions	Enterprise & Innovatio	Work Experience
High Degree of Alignment With Apprenticeable Trades	Agricultural Mechanic	▨					▨		▨				■	▨	▨	▨
	Autobody Mechanic								▨				■	▨	▨	▨
	Baker										■			▨	▨	▨
	Cabinetmaker			■										▨	▨	▨
	Carpenter			■		▨								▨	▨	▨
	Communication Electrician		▨				■							▨	▨	▨
	Cook										■			▨	▨	▨
	Electrician			▨			■							▨	▨	▨
	Electronic Technician						■							▨	▨	▨
	Hairstylist				■									▨	▨	▨
	Heavy Duty Mechanic						▨		▨				■	▨	▨	▨
	Landscape Gardener	■		▨		▨						▨	▨	▨	▨	▨
	Machinist					▨			■				▨	▨	▨	▨
	Motorcycle Mechanic						▨		▨				■	▨	▨	▨
	Motor Mechanic						▨		▨				■	▨	▨	▨
	Printing & Graphic Arts Craftsman		■			■	▨			▨				▨	▨	▨
	Sheet Metal Worker					▨			■					▨	▨	▨
	Tool & Die Maker					▨			■					▨	▨	▨
	Welder						▨		■				▨	▨	▨	▨
Partial Alignment With Apprenticeship Trades	Appliance Serviceman						▨						▨	▨	▨	▨
	Boilermaker							▨	▨					▨	▨	▨
	Bricklayer			▨										▨	▨	▨
	Cement Finisher			▨										▨	▨	▨
	Crane & Hoisting Equipment Operator			▨				▨						▨	▨	▨
	Electrical Rewind Mechanic						▨							▨	▨	▨
	Elevator Constructor								▨					▨	▨	▨
	Floorcovering Installer			▨										▨	▨	▨
	Gasfitter								▨					▨	▨	▨
	Glassworker					▨								▨	▨	▨
	Instrument Mechanic						▨							▨	▨	▨
	Insulator			▨										▨	▨	▨
	Ironworker								▨					▨	▨	▨
	Lather-Interior System Mechanic			▨										▨	▨	▨
	Millwright						▨		▨				▨	▨	▨	▨
	Painter & Decorator			▨		▨				▨				▨	▨	▨
	Partsman						▨						▨	▨	▨	▨
	Plasterer			▨										▨	▨	▨
	Plumber			▨										▨	▨	▨
	Power Lineman						▨							▨	▨	▨
	Power System Electrician						▨							▨	▨	▨
	Projectionist		▨				▨							▨	▨	▨
	Recreation Vehicle Mechanic			▨			▨		▨				▨	▨	▨	▨
	Refrigeration & Air Conditioning Mechanic			▨			▨						▨	▨	▨	▨
	Roofer			▨										▨	▨	▨
	Sawfiler			▨										▨	▨	▨
	Circular Sawfiler			▨										▨	▨	▨
	Sprinkler Systems Installer								▨					▨	▨	▨
	Steamfitter-Pipefitter							▨	▨					▨	▨	▨
	Structural Steel and Plate Fitter								▨					▨	▨	▨
	Tilesetter			▨										▨	▨	▨
	Transport Refrigeration Mechanic												▨	▨	▨	▨
	Water Well Driller							▨						▨	▨	▨

CTS Strands that deliver many of the competencies/program defined in the first period of the apprenticeship program ■
CTS Strands that deliver some of the competencies/program defined in the first period of the apprenticeship program ▨

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TRANSITIONS – *Mechanics: Related Occupations*

Information for this chart was obtained from the National Occupational Classification (NOC) descriptions.

Educational Requirements:

D:	High School Education	B:	College or Vocational Education
C:	Apprenticeship	A:	University

Occupational Profile	NOC#	D	C	B	A
Agriculture Mechanics/Farm Equipment Mechanics	7216		✓	✓	
Aircraft Maintenance Engineer	7315	✓		✓	
Appliance Serviceman	7332		✓	✓	
Assemblers, Fabricators and Inspectors, Industrial Electrical Motors and Transformers	9485	✓		✓	
Auto Body Mechanic	7322		✓	✓	
Automotive Mechanical Installers and Servicers	7321	✓			
Carman	7314	✓			
Construction Millwrights and Industrial Mechanics (except Textile)	7311		✓	✓	
Contractors and Supervisors, Mechanic Trades	7216		✓	✓	
Electronic Assemblers, Fabricators, Inspectors and Testers	9483	✓			
Elevator Constructors and Mechanics	7318		✓	✓	
Heavy Duty Equipment Mechanics	7312		✓	✓	
Industrial Instrument Technicians and Mechanics	2243		✓	✓	
Machine Fitter	7316		✓	✓	
Machine Operators and Inspectors, Electrical Apparatus Manufacturing	9487	✓			
Machinists and Machining and Tooling Inspectors	7231		✓	✓	
Maintenance Manager	0722			✓	✓
Manufacturing Manager	0911			✓	✓
Mechanical Assemblers and Inspectors	2244	✓			
Mechanical Engineer	2132				✓
Mechanical Engineering Technologist	2232			✓	
Motor Mechanic	7321		✓		
Motorcycle Mechanic	7334		✓		
Motor Vehicle Body Repairer	7322		✓	✓	
Motor Vehicle Mechanics, Technicians and Mechanical Repairers	7322		✓	✓	
Oil and Solid Fuel Heating Mechanics	7331		✓	✓	
Other Small Engine and Equipment Mechanics	7335		✓	✓	
Other Trades and Related Occupations	7383		✓	✓	
Other Trades Helpers and Labourers	7612	✓			

TRANSITIONS – *Mechanics: Related Occupations* *(continued)*

Occupational Profile	NOC#	D	C	B	A
Partsman	1472		✓	✓	
Power Engineer	7351				✓
Refrigeration and Air Conditioning Mechanics	7313		✓	✓	
Recreation Vehicle Mechanic	7383		✓	✓	
Storekeepers and Parts Clerks	1472	✓		✓	
Supervisors, Machinists and Related Occupations	7211		✓	✓	
Supervisors, Motor Vehicle Assembling	9221	✓			
Supervisors, Other Mechanical and Metal Products Manufacturing	7211	✓			
Textile Machinery Mechanics and Repairers	7317	✓			
Tool and Die Makers	7232		✓	✓	
Transportation Refrigeration Mechanic	7313		✓	✓	

TRANSITIONS – *Mechanics: Summary of Post-secondary Programs*

	PUBLIC COLLEGES											APPRENTICESHIP TRADE	PRIVATE COLLEGES						TECH. INST.		Banff	UNIVERSITIES				VOCATIONAL COLLEGES			
	Alberta College of Art & Design	Fairview College	Grande Prairie Regional College	Grant MacEwan Community College	Keyano College	Lakeland College	Lethbridge Community College	Medicine Hat College	Mount Royal College	Olds College	Red Deer College		Alberta College	Augustana University College	Canadian Union College	Concordia College	King's University College, The	North American Baptist College	Northern Alberta Institute of Technology	Southern Alberta Institute of Technology	Banff Centre	Athabasca University	University of Alberta	University of Calgary	University of Lethbridge	AVC - Calgary	AVC - Edmonton	AVC - Lac La Biche	AVC - Lesser Slave Lake
Aeronautical/Mechanical Engineering Technology																				CD (3y)									
Aircraft Maintenance Engineering/Engineers Technology																			V	VD									
Aviation/Avionics Technology								D	D		D								C	D									
Computer Maintenance/Repair																			CD	V									
Mechanical Engineering Technologies							D												D	D									
Other Construction-related Apprenticeship Trades (including Lather-Interior Systems Mechanic)												3y																	
Other Electrical Trades (including Instrument Mechanic)												4y								28w									
Agricultural Mechanic						C(16 w)				D		2y																	
Appliance Serviceman												3y																	
Auto Body Technician												3y																	
Heavy Equipment Technicians (including Diesel Mechanics, Industrial Heavy Equipment Technician/Technology, Journeyman updating & Pre-employment)		VC			8w	C(16 w)	C				30w	4y							CD	C									
Machinist												4y							C										
Marine Service Technician		C																											

CODES:

B	Bachelor's Degree	D	Diploma (2 years)	w	weeks
M	Master's Degree	V	Varies	m	months
Ph.D.	Doctoral Degree	1t	One-year transfer	y	years
C	Certificate (1 year or less)	2t	Two-year transfer		

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	PUBLIC COLLEGES												PRIVATE COLLEGES						TECH. INST.		Banff	UNIVERSITIES				VOCATIONAL COLLEGES			
	Alberta College of Art & Design	Fairview College	Grande Prairie Regional College	Grant MacEwan Community College	Keyano College	Lakeland College	Lethbridge Community College	Medicine Hat College	Mount Royal College	Olds College	Red Deer College	**APPRENTICESHIP TRADE**	Alberta College	Augustana University College	Canadian Union College	Concordia College	King's University College, The	North American Baptist College	Northern Alberta Institute of Technology	Southern Alberta Institute of Technology	Banff Centre	Athabasca University	University of Alberta	University of Calgary	University of Lethbridge	AVC - Calgary	AVC - Edmonton	AVC - Lac La Biche	AVC - Lesser Slave Lake
Automotive Service Technicians		C			8w	C(12 w)	D	8w			D	4y							C	VD									
Motorcycle Mechanic/Specialty Mechanics		C										4y																	
Recreation Vehicle Mechanic												3y																	
Refrigeration and Air Conditioning Mechanic												4y																	
Transport Refrigeration Mechanic												3y																	

CODES:	B	Bachelor's Degree	D	Diploma (2 years)	w	weeks
	M	Master's Degree	V	Varies	m	months
	Ph.D.	Doctoral Degree	1t	One-year transfer	y	years
	C	Certificate (1 year or less)	2t	Two-year transfer		

*Information taken from "It's About Time: To Start Thinking About Your Future," Advanced Education and Career Development, 1995.

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CREDENTIALLING – *Mechanics: Credentialling Opportunities*★

The following credentialling opportunities link with modules in Mechanics and other strands.

Certificate	Agency	Linking Modules	Instructor Qualifications	Comments
Emergency First Aid	St. John Ambulance Canadian Red Cross	Personal Safety (Management) (CTR1210)	Certified First Aid/CPR Instructor	Three-year nationally recognized certificate
Power Engineering Technology	Power Engineering Department, SAIT	Practicum Modules (CTR Practicum Modules A-E (CTR3040–3080)	Certified instructor from industry	A modular and computer-enhanced learning program available through the SAIT Open Learning Instruction Systems (SOLIS) that links with Third Class Power Engineering
Workplace Hazardous Materials Information Systems (WHMIS)	Occupational Health and Safety	Personal Safety (Management) (CTR1210)	WHMIS Instructor	Addresses skills required to work safely with hazardous materials
Transportation of Dangerous Goods (TDG)	Transportation and Utilities	Workplace Safety (Practices) (CTR2210)	TDG Instructor	Addresses skills required by individuals involved with the transportation and handling of dangerous goods

★ Further information regarding these and other credentialling opportunities available to CTS students is available through Alberta Education's web site <http://ednet.edc.gov.ab.ca>.

MECHANICS

SECTION I: LEARNING RESOURCE GUIDE

This section of the GSI has been designed to provide a list of resources that support student learning.

Three types of resources are identified:

- Authorized: Resources authorized by Alberta Education for CTS curriculum; these resources are categorized as basic, support, or teaching
- Other: Titles provided as a service to assist local jurisdictions to identify resources that contain potentially useful ideas for teachers. Alberta Education has done a preliminary review of these resources, but further review will be necessary prior to use in school jurisdictions
- Additional: A list of local, provincial and national sources of information available to teachers, including the community, government, industry, and professional agencies and organizations.

The information contained in this Guide, although as complete and accurate as possible as of June 1997, is time-sensitive.

For the most up-to-date information on learning resources and newer editions/versions, consult the LRDC *Buyers Guide* and/or the agencies listed in the Distributor Directory at the end of this section.

CTS is on the Internet.
Internet Address:
http://ednet.edc.gov.ab.ca

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INTRODUCTION

CTS AND THE RESOURCE-BASED CLASSROOM

Career and Technology Studies (CTS) encourages teachers to establish a resource-based classroom, where a variety of appropriate, up-to-date print and nonprint resources are available. Learning resources identified for CTS strands include print, software, video and CD-ROM formats. Also of significance and identified as appropriate throughout each strand are sources of information available through the Internet.

The resource-based classroom approach accommodates a variety of instructional strategies and teaching styles, and supports individual or small group planning. It provides students with opportunities to interact with a wide range of information sources in a variety of learning situations. Students in CTS are encouraged to take an active role in managing their own learning. Ready access to a strong resource base enables students to learn to screen and use information appropriately, to solve problems, to meet specific classroom and learning needs, and to develop competency in reading, writing, speaking, listening and viewing.

PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this document is to help teachers identify a variety of resources to meet their needs and those of the students taking the new CTS curriculum. It is hoped that this practical guide to resources will help teachers develop a useful, accessible resource centre that will encourage students to become independent, creative thinkers.

This document is organized as follows:

- Authorized Resources:
  - – basic learning resources
  - – support learning resources
  - – teaching resources
- Other Resources
- Additional Sources
- Distributor Directory.

Some resources in the guide have been authorized for use in some or all of the CTS strands, e.g., the Career and Technology Studies video series produced by ACCESS: The Education Station. Further information is provided in relevant sections of this resource guide.

Each resource in the guide provides bibliographic information, an annotation where appropriate, and a module correlation to the CTS modules. The distributor code for each entry will facilitate ordering resources. It is recommended that teachers preview all resources before purchasing, or purchase one copy for their reference and additional copies as required.

Distributor Code	Resources		Levels/Mod. No.		
			1	2	3
ACC	Title	Author	1010	2010	3010
	Bibliographic Information				
	Annotation				

Distributor Code - see Distributor Directory

1 = Introductory
2 = Intermediate
3 = Advanced

Indicates module number

HOW TO ORDER

Most authorized resources are available from the Learning Resources Distributing Centre (LRDC) at:

12360 – 142 Street
Edmonton, AB T5L 4X9.
Telephone: 403–427–5775 (outside of Edmonton dial 310–0000 to be connected toll free)
Fax: 403–422–9750
Internet: http://ednet.edc.gov.ab.ca/lrdc

Please check LRDC for availability of videos.

RESOURCE POLICY

Alberta Education withdraws learning and teaching resources from the provincial list of approved materials for a variety of reasons; e.g., the resource is out of print; a new edition has been published; the program has been revised. Under section 44 (2) of the *School Act*, school boards may approve materials for their schools, including resources that are withdrawn from the provincial list. **Many school boards have delegated this power to approve resources to school staff or other board employees under section 45 (1) of the *School Act*.**

For further information on resource policy and definitions, refer to the *Student Learning Resources Policy* and *Teaching Resources Policy* or contact:

Learning Resources Unit, Curriculum Standards Branch
Alberta Education
5th Floor, Devonian Building, East Tower
11160 Jasper Avenue
Edmonton, AB T5K 0L2
Telephone: 403–422–4872 (outside of Edmonton dial 310–0000 to be connected toll free)
Fax: 403–422–0576
Internet: http://ednet.edc.gov.ab.ca

Note: Owing to the frequent revisions of computer software and their specificity to particular computer systems, newer versions may not be included in this guide. However, schools may contact the LRDC directly at 403–427–5775 for assistance in purchasing computer software.

Trademark Notices: Microsoft, Access, Excel, FoxPro, Mail, MS-DOS, Office, PowerPoint, Project, Publisher, Visual Basic, Visual C++, Windows, Windows NT, Word, and Works are either registered trademarks or trademarks of Microsoft Corporation. Apple, Mac, Macintosh, and Power Macintosh are either registered trademarks or trademarks of Apple Computer, Inc. Other brand and product names are registered trademarks or trademarks of their respective holders.

AUTHORIZED RESOURCES

BASIC LEARNING RESOURCES

The following basic learning resources have been authorized by Alberta Education for use in the Mechanics curriculum. These resources address the majority of the learner expectations in one or more modules and/or levels. A curriculum correlation appears in the right-hand column.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Auto Body Repair and Refinishing.* (3rd edition.) John W. Hogg. McGraw-Hill Ryerson, 1988. Introduces practical and theoretical aspects of auto body repair and refinishing.	1090 1160 1170 1190	2150 2160 to 2200 2220	3190 3210
LRDC	*AutoBody Repairing and Refinishing.* W. Toboldt and T. Richardson. Goodheart-Willcox Company Inc. Irwin Publishing, 1993. A comprehensive, well detailed and visually appealing text. The content is current and represents theory and procedures used by technicians in the trade. Format makes knowledge transfer easy for all levels of readers. Color pictures enhance the esthetic aspects of this text. A workbook and instructor's manual are available.	1150 1160 1170 1190	2150 to 2220	3150 to 3210
LRDC	*Car Care Book, The.* (2nd edition.) Fred Barbarossa and G. Bono Savero. Delmar Publishers. Nelson Canada, 1988. Of interest to those with a general interest in mechanics. Reading level and content correlates well with introductory modules. An instructor's guide is available.	1020 to 1150	2020	3010 3020
LRDC	*Modern Automotive Technology.* James E. Duffy. Goodheart-Willcox Company Inc. Irwin Publishing, 1994. The resource provides an easy-to-understand, up-to-date book summarizing the operation and repair of all makes and models of vehicles. The resource uses a "building block" approach that starts with the simple and progresses gradually to the more complex. Each automotive system is presented in two or more chapters. A student workbook contains 76 short answers, content tests and 17 job sheets. A teacher's resource binder and instructor's guide are available.	1010 1020 1040 1090 1150	2020 2030 2040 to 2160	3030 to 3150
LRDC	*Motor Auto Body Repair.* Robert Scharff. Delmar Publishers. Nelson Canada, 1992. Covers auto body repair, with excellent diagrams and resources. An instructor's guide is available.	1160 1170 1190	2170 to 2210	3160 to 3220

SUPPORT LEARNING RESOURCES

The following support learning resources are authorized by Alberta Education to assist in addressing some of the learner expectations of a module or components of modules.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*AutoBody Repairing and Refinishing.* W. Toboldt and T. Richardson. Goodheart-Willcox Company Inc. Irwin Publishing, 1993. Workbook. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Auto Electricity and Electronics, Technology.* James Duffy. Goodheart-Willcox Co. Inc. Irwin Publishing, 1995. Text and Student Workbook. Discusses electrical/electronic principles, and provides diagrams, testing and repair techniques of major electrical/electronic systems on a vehicle. This new version has replaced the term "mechanic" with "technician" and includes information on air bag system service and electronically controlled transmission service.. Chapters in the workbook include electrical-electronic principles, diagrams, testing with sample ASE questions. An instructor's guide is available.	1090	2060 2090	3030 3040 3080 to 3110
LRDC	*Auto Engines.* James Duffy and John Hurt. Goodheart-Willcox Co. Inc. Irwin Publishing, 1993. Text and Student Workbook. ✪ The text covers fundamental aspects of engine design and shop safety. Engine systems, problem diagnosis, tune-up and maintenance and rebuilding of engines is covered. There is a chapter on careers and certification opportunities available for automotive service workers. This new version has minor changes, such as replacing the term "mechanic" to "technician". Diagrams and photographs have been interchanged from one manufacturer to another without changing the content. The workbook contains 30 chapters of short answer questions related to engines with sample ASE questions and suggested activities. An instructor's guide and answer key are available.	1040 1090	2020 to 2070 2090	3030 to 3070
LRDC	*Auto Fuel and Emission Control Systems Technology.* James Duffy and J. Smith. Goodheart-Willcox Co. Inc., 1992. Text and Student Workbook. Covers basic fuel and emission control systems. An instructor's guide and student workbook are available.		2040 2070	3030 3040
LRDC	*Auto Shop Safety.* Meridian Education Corporation. McIntrye Media Ltd., 1992. Video. This video is designed to give basic safety instruction using the following sections: shop areas, types of accidents, tools and safety, and general safety.	1020 to 1130		

✪ A newer edition/version of this resource may be available. Consult the *LRDC Buyers Guide* or the appropriate resource distributor for the most recent edition/version available.

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Automatic Transmission: A Text-Lab Manual.* (2nd edition.) Sheldon L. Abbott. Glencoe Publishing Company, 1989. Text and Lab Manual. Covers theory, diagnosis, in-car service and overhaul of automatic transmissions and transaxles. An instructor's manual is available.		2020	3130
LRDC	*Automotive Air Conditioning and Heating: A Text-Lab Manual.* Ivan Hinerman and Thomas Birch. Glencoe Publishing Company, 1987. Text and Lab Manual. Presents a broad overview of heating and refrigeration. Service procedures are well documented. An instructor's guide is available.		2020	3110
LRDC	*Automotive Technology: A Systems Approach.* (2nd edition.) Jack Erjavec and Robert Scharff. Delmar Publishers. ITP Nelson Canada, 1996. Text and Tech Manual. A comprehensive guide to the service and repair of our contemporary automobiles. The text is divided into nine sections that relate to specific automotive systems. It has excellent illustrations with many coloured diagrams. An instructor's guide is available.	1020 1040 1090 1110 1150	2020 to 2160	3030 to 3150
ACC	*Career and Technology Studies: Key Concepts.* Edmonton, AB: ACCESS: The Education Station. A series of videos and utilization guides relevant to all CTS strands. The series consists of: *Anatomy of a Plan; Creativity; Electronic Communication; The Ethics Jungle; Go Figure; Innovation; Making Ethical Decisions; Portfolios; Project Planning; Responsibility* and *Technical Writing*.	all	all	all
LRDC	*Complete Automotive Welding: Metals and Plastics.* Robert Scharff and Dave Caruse. Delmar Publishers, 1990. This resource covers welding safety, MIG welding, oxyacetylene, plasma arc, TIG, spot welding, brazing, plastic welding and fibreglass repair techniques. An instructor's guide is available.		2170	3210
LRDC	*Complete Engine Performance and Diagnostics.* Robert Scharff. Delmar Publishers, 1989. Text and Student Technician's Shop Manual. Covers engine performance, especially electrical components. An instructor's guide is available.		2030 2040 2060 2070 2090	3030 3040
LRDC	*Complete Under Car Systems: Steering and Suspension.* Robert Scharff. Delmar Publishers, 1989. Text and Student Technician's Shop Manual. Excellent coverage of steering suspension, drive shaft, tires, wheels and under-car inspection. Manual includes questions and job sheets for chapters covered in the text. An instructor's guide is available.	1150	2100 2120 2150 2160	3140 3150

Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Engineering Technology: Hydraulics and Pneumatics, Part I and Part II.* (IBM version.) Shopware Educational Systems. Computer Disks (6), 1993. Courseware. Computer program is in two parts. Part I: introduction to fluid power; scientific principles of fluids; hydraulics. Part II: pneumatics; graphic symbols; advantages of fluid power. Both Part I and Part II have three sections with approximately 31 visuals and print, and a 10 question quiz for each section. The program records student the score for each section and tells the student to repeat lesson if he/she fails.	1110		
LRDC	*I-Car Professional Automotive Collision Repair.* James E. Duffy, et al. Delmar Publishers. ITP Nelson Canada, 1996. Textbook and Technician's Manual. A comprehensive resource for unibody collision repair and refinishing. An instructor's guide is available.	1160 1170 1190	2170 2180	3170 to 3220
LRDC	*Modern Automotive Technology*. James E. Duffy. Irwin Publishing, 1994. Student Workbook. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Small Gas Engines.* Alfred Roth. Goodheart-Willcox Co. Inc., 1992. Text and Workbook. Focuses on the design, structure and repair of small engines using colour photos and precise text. An instructor's guide is available.	1040	2030 2040 2060	
LRDC	*Step-By-Step Guide to Engine Building.* R. Voegelin. S-A Design Books. Dix Performance North, 1988. The resource describes blueprinting, cylinder block, crankshaft, connecting rods, pistons, cylinder heads, and camshaft. A chapter on determining compression ratio, balancing and engine assembly tips is also provided. Note: The statement on page 18, "what hell must be like" may be considered inappropriate to some readers.			3060 3070
LRDC	*Technology: Today & Tomorrow.* (3rd edition.) J. Fales and V. Kuetemeyer, et al. Glencoe/McGraw-Hill, 1997. Text and Student Workbook. This resource deals with five important areas of technology – communication, manufacturing, transportation, construction and biotechnology. In addition, the problem solving process is defined, parts of a technological system are explained and curricular and cross-curricular activities are provided. Imperial measurements are used throughout this resource. Teacher's annotated edition, teacher's resource binder, making connections, and media correlations are available.	1010 1040		

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Support Learning Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Today's Electrician: Classroom Manual for Automotive Computer Systems.* D. Knowles and J. Erjavec. Delmar Publishers. ITP Nelson Canada, 1996. This resource provides step-by-step instructions for diagnosing and repairing computer controlled ignition, fuel, instruments clusters, air bag systems, transmissions, antilock brakes and air conditioning systems. Chapters consists of performance objectives, cautions and warnings, customer care, tool lists, service tips, case studies, terms to know, diagnostic charts and review questions. Each chapter includes numerous graphics and photo sequences to illustrate specific tasks. A shop manual is included (see Teaching Resources).		2060	3030 3040 3090 3100 3110

TEACHING RESOURCES

The following teaching resources are authorized by Alberta Education to assist teachers in the instructional process.

Distributor Code	Resources	Levels/Module No.		
		1	2	33
LRDC	*AutoBody Repairing and Refinishing.* W. Toboldt and T. Richardson. Goodheart-Willcox Company Inc. Irwin Publishing, 1993. Instructor's Manual. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Auto Electricity and Electronics Technology.* James Duffy and N. Henke-Konopasek. Goodheart-Willcox Co. Inc. Irwin Publishing, 1995. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Auto Engines.* James Duffy. Goodheart-Willcox Co. Inc. Irwin Publishing, 1993. Instructor's Guide. ✪ See Support Learning Resources for annotation and module correlation.			
LRDC	*Auto Fuel and Emission Control Systems Technology.* James Duffy and H.B. Smith. Goodheart-Willcox Co. Inc., 1992. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Automatic Transmissions: A Text-Lab Manual.* (2nd edition.) Sheldon L. Abbott. Glencoe Publishing Co., 1988. Instructor's Manual. See Support Learning Resources for annotation and module correlation.			
LRDC	*Automotive Air Conditioning and Heating.* Ivan Hinerman and Thomas Birch. Glencoe Publishing Company, 1988. Instructor's Manual. See Support Learning Resources for annotation and module correlation.			
LRDC	*Automomotive Brake Systems.* (HarperCollins/Check-Mart Automotive Series.) (2nd edition.) R. K. DuPuy, et al. HarperCollins Canada Ltd., 1996. Classroom Manual/Shop Manual. These resources lead students from basic theories to hands-on experience. The resources are divided into classroom manual and shop manual which complement each other. The resources provide descriptive information, study lessons and representative testing questions on basic repair and overhaul procedures. The resources cover general brake service operations, brake hydraulic system service, wheel function assembly service, brake subsystem testing and service, bearing, tire, wheel and chassis service.	1110	2020 2100 2110 2120	3100

✪ A newer edition/version of this resource may be available. Consult the *LRDC Buyers Guide* or the appropriate resource distributor for the most recent edition/version available.

Teaching Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Automotive Electrical & Electronic Systems.* (HarperCollins / Check-Mart Automotive Series.) (3rd edition.) R. K. DuPuy, et al. HarperCollins Canada Ltd., 1994. Classroom Manual/Shop Manual. These resources lead students from basic theories to hands-on experience. The resources are divided into classroom manual and shop manual which complement each other. The resources provide descriptive information, study lessons, test questions, repair and overhaul procedures. Chapters deal with electrical fundamentals, basic automotive electrical systems and components, ignition system, electronic engine controls, lighting, accessories and body electrical systems	1090	2010 2060 2090	3040 3090 3100 3110
LRDC	*Automotive Steering, Suspension, & Wheel Alignment.* (HarperCollins/ Check-Mart Automotive Series.) (1st edition.) R. K. DuPuy, et al. HarperCollins Canada Ltd., 1993. Classroom Manual/Shop Manual. These resources lead students from basic steering/suspension theories to hands-on experience. The resources are divided into classroom manual and shop manual which complement each other. The resources provide descriptive information, study lessons, and representative questions on basic repair and overhaul procedures. The resources cover general theory (classroom manual) and service on steering systems, suspension systems, wheel/tire and wheel alignment service.	1090	2100 2150 2160	3120 3150
LRDC	*Automotive Technology: A Systems Approach.* (2nd edition.) Jack Enjavec and Robert Scharff. Delmar Publishers. ITP Nelson Canada, 1996. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Car Care Book, The.* Fred Barbarossa and G. Bono Savero. Nelson Publishers, 1988. Instructor's Guide. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Complete Automotive Welding: Metals and Plastics.* Robert Scharff and Dave Caruse. Delmar Publishers, 1990. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Complete Engine Performance and Diagnostics.* Robert Scharff. Delmar Publish, 1989. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Complete Under Car Systems: Steering and Suspension.* Robert Scharff. Delmar Publishers, 1989. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			

Teaching Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Design and Technology.* Colin Coborn, Ian Mould and John Cave. Nelsonc Canada Co., 1989. Text. Provides numerous projects and design techniques useful for Modes and Mechanisms.	1010		
LRDC	*Fuel Systems and Emission Controls.* (HarperCollins/Check-Mart Automotive Series.) (3rd edition.) R. K. DuPuy, et al. HarperCollins Canada Ltd., 1994. Classroom Manual/Shop Manual. These resources lead students from basic theories to hands-on experience. The resources are divided into classroom manual and shop manual which complement each other. The resources provide descriptive information, study lessons and testing questions on repair and overhaul procedures. Chapters deal with introduction to fuel and emission system service, fuel system service, carburetor, electronic engine control and fuel system service, emission control testing and service. **Note:** These resources have one section providing ASE sample multiple choice test questions.		2040 2050 2060 2070 2090	3030 3040 3090
LRDC	*I-Car Professional Automotive Collision Repair.* James E. Duffy and Chris Johanson. Delmar Publishers. ITP Nelson Canada, 1996. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			
LRDC	*Modern Automotive Technology.* James E. Duffy. Irwin Publishing, 1994. Instructor's Guide and Teacher's Resource Binder. See Support Learning Resources for annotation and module correlation.			
LRDC	*Mechanisms: Modular Courses in Technology.* Amay Bailey, Roy Pickup, Ray Lewis and Peter Patient. Oliver and Boyd, 1981. An introductory resource for levers, pulleys, gears, cams, couplings, shafts, bearings and steering.	1010 1040 1130 1150		
LRDC	*Motor Auto Body Repair.* Robert Scharff. Delmar Publishers, 1992. Instructor's Guide. See Basic Learning Resources for annotation and module correlation.			
LRDC	*Small Gas Engines.* Alfred Roth. Goodheart-Willcox Co. Inc., 1992. Instructor's Guide. See Support Learning Resources for annotation and module correlation.			

Teaching Resources (continued)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Technology: Today & Tomorrow.* (3rd edition.) J. Fales and V. Kuetemeyer, et al. Glencoe/McGraw-Hill, 1997. Teacher's Annotated Edition; Teacher's Resource Binder (NOTE: Authors are C. Haller. And E. Thompson); Making Connections; Media Correlations. See Support Learning Resources for annotation and module correlation.			
LRDC	*Today's Electrician: Shop Manual for Automotive Computer Systems.* D. Knowles and J. Erjavec. Delmar Publishers. ITP Nelson Canada, 1996. See Support Learning Resources for annotation and module correlation.			
LRDC	*Today's Technician: Manual Transmissions and Transaxles.* Jack Erjavec. Delmar Publishers, 1994. Shop Manual and Classroom Manual. Shop Manual provides introductory and service information on standard transmissions and a transaxles. Classroom Manual provides principles of operation and step-by-step approach to diagnose and repair manual transmissions and transaxles.	1130	2130 2140	3140

MECHANICS RESOURCES

THEME CODE:
A. Vehicle Design & Ownership
B. Propulstion Systems
C. Guidance & Control Systems
D. Suspension & Structural Systems

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
J - Junior
S - Senior

LEVEL				1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES				A	A	B	C	C	C	D	D	D	D	A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	Format	*Status*	*Junior/Senior High*	Modes & Mechanisms	Vehicle Service & Care	Engine Fundamentals	Electrical Fundamentals	Pneumatics & Hydraulics	Mechanical Systems	Ride & Control Systms	Structures & Materials	Metal Forming & Finishing	Surface Preparation 1	Vehicle Detailing	Vehicle Maintenance	Lubrication & Cooling	Fuel & Exhaust Systems	Alternate Fuel Engines	Ignition Systems	Emission Controls	Electrical Components	Power Assist Accessories	Braking Systems	Hydraulic Accessories	Drive Trains	Transmissions/Transaxles	Suspension Systems	Steering Systems	Metal Repair & Finishing	Trim Replacement	Surface Preparation 2	Refinishing 1	Touch-up & Finishing	Interior Repairs	Buying & Selling Vehicles	Vehicle Value Appraisal	Engine Diagnosis	Engine Tune-up	Engine Replacement	Engine Reconditioning 1	Engine Reconditioning 2	Alternate Energy Systems	Computer Systems	Safety Systems	Climate Control	Power Assisting	Automatic Transmissions	Drive Train Repair	Wheel Alignment	Body Repair Estimation	Damage Analysis	Damage Repair 1	Damage Repair 2	Refinishing 2	Plastic & Fibreglass	Glass Replacement	Refinishing 3
Module Number				1010	1020	1040	1090	1110	1130	1150	1160	1170	1190	2010	2020	2030	2040	2050	2060	2070	2090	2100	2110	2120	2130	2140	2150	2160	2170	2180	2190	2200	2210	2220	3010	3020	3030	3040	3050	3060	3070	3080	3090	3100	3110	3120	3130	3140	3150	3160	3170	3180	3190	3200	3210	3220	3230
Auto Body Repair and Refinishing	*p*	*B*	*J/S*				X				X	X	X														X	X	X	X	X	X		X																			X		X		
AutoBody Repairing and Refinishing										X	X	X	X														X	X	X	X	X	X	X	X															X	X	X	X	X	X	X		
Text	*p*	*B*	*J/S*																																																						
Workbook	*p*	*S*	*J/S*																																																						
Instructor's Manual	*p*	*T*	*J/S*																																																						
Auto Electricity, Electronics, Technology							X												X		X																X	X				X	X	X	X												
Text	*p*	*S*	*S*																																																					
Student Workbook	*p*	*S*	*S*																																																					
Instructor's Guide	*p*	*T*	*S*																																																					
Auto Electricity and Electronics Technology													X						X		X																X	X				X	X	X	X												
Text & Workbook	*p*	*S*	*J/S*																																																						
Instructor' Guide	*p*	*T*	*J/S*																																																						

MECHANICS RESOURCES (continued)

THEME CODE:
A. Vehicle Design & Ownership
B. Propulstion Systems
C. Guidance & Control Systems
D. Suspension & Structural Systems

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
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T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
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JR/SR HIGH CODE:
J - Junior
S - Senior

	Format	*Status*	*Junior/Senior High*	Modes & Mechanisms	Vehicle Service & Care	Engine Fundamentals	Electrical Fundamentals	Pneumatics & Hydraulics	Mechanical Systems	Ride & Control Systems	Structures & Materials	Metal Forming & Finishing	Surface Preparation 1
LEVEL				1	1	1	1	1	1	1	1	1	1
THEMES				A	A	B	C	C	C	D	D	D	D
Module Number				1010	1020	1040	1090	1110	1130	1150	1160	1170	1190
Auto Engines						X	X						
Text & Workbook	*p*	*S*	*S*										
Instructor's Guide	*p*	*T*	*S*										
Auto Fuel and Emission Control Systems Technology													
Test	*p*	*S*	*S*										
Instructor's Manual	*p*	*T*	*S*										
Auto Shop Safety	*v*	*S*	*J/S*		X	X	X	X	X				
Automatic Transmissions													
Text	*p*	*S*	*S*										
Lab Manual	*p*	*S*	*S*										
Instructor's Manual	*p*	*T*	*S*										

	Vehicle Detailing	Vehicle Maintenance	Lubrication & Cooling	Fuel & Exhaust Systems	Alternate Fuel Engines	Ignition Systems	Emission Controls	Electrical Components	Power Assist Accessories	Braking Systems	Hydraulic Accessories	Drive Trains	Transmissions/Transaxles	Suspension Systems	Steering Systems	Metal Repair & Finishing	Trim Replacement	Surface Preparation 2	Refinishing 1	Touch-up & Finishing	Interior Repairs
LEVEL	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
THEMES	A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D
Module Number	2010	2020	2030	2040	2050	2060	2070	2090	2100	2110	2120	2130	2140	2150	2160	2170	2180	2190	2200	2210	2220
Auto Engines		X	X	X	X	X	X	X													
Text & Workbook																					
Instructor's Guide																					
Auto Fuel and Emission Control Systems Technology				X			X														
Test																					
Instructor's Manual																					
Auto Shop Safety																					
Automatic Transmissions		X																			
Text																					
Lab Manual																					
Instructor's Manual																					

	Buying & Selling Vehicles	Vehicle Value Appraisal	Engine Diagnosis	Engine Tune-up	Engine Replacement	Engine Reconditioning 1	Engine Reconditioning 2	Alternate Energy Systems	Computer Systems	Safety Systems	Climate Control	Power Assisting	Automatic Transmissions	Drive Train Repair	Wheel Alignment	Body Repair Estimation	Damage Analysis	Damage Repair 1	Damage Repair 2	Refinishing 2	Plastic & Fibreglass	Glass Replacement	Refinishing 3
LEVEL	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
Module Number	3010	3020	3030	3040	3050	3060	3070	3080	3090	3100	3110	3120	3130	3140	3150	3160	3170	3180	3190	3200	3210	3220	3230
Auto Engines			X	X	X	X	X																
Text & Workbook																							
Instructor's Guide																							
Auto Fuel and Emission Control Systems Technology			X	X																			
Test																							
Instructor's Manual																							
Auto Shop Safety																							
Automatic Transmissions													X										
Text																							
Lab Manual																							
Instructor's Manual																							

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MECHANICS RESOURCES (continued)

THEME CODE:
A. Vehicle Design & Ownership
B. Propulstion Systems
C. Guidance & Control Systems
D. Suspension & Structural Systems

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
J - Junior
S - Senior

	Format	*Status*	*Junior/Senior High*	Modes & Mechanisms	Vehicle Service & Care	Engine Fundamentals	Electrical Fundamentals	Pneumatics & Hydraulics	Mechanical Systems	Ride & Control Systems	Structures & Materials	Metal Forming & Finishing	Surface Preparation 1
LEVEL				1	1	1	1	1	1	1	1	1	1
THEMES				A	A	B	C	C	C	D	D	D	D
Module Number				1010	1020	1040	1090	1110	1130	1150	1160	1170	1190
Automotive Air Conditioning and Heating													
Text	*p*	*S*	*S*										
Lab Manual	*p*	*S*	*S*										
Instructor's Manual	*p*	*T*	*S*										
Automotive Brake								X					
Classroom Manual	*p*	*T*	*J/S*										
Shop Manual	*p*	*T*	*J/S*										
Automotive Electrical & Electronic Systems							X						
Classroom Manual	*p*	*T*	*J/S*										
Shop Manual	*p*	*T*	*J/S*										
Automotive Steering, Suspension & Wheel Alignment							X						
Classroom Manual	*p*	*T*	*J/S*										
Shop Manual	*p*	*T*	*J/S*										

	Format	*Status*	*Junior/Senior High*	Vehicle Detailing	Vehicle Maintenance	Lubrication & Cooling	Fuel & Exhaust Systems	Alternate Fuel Engines	Ignition Systems	Emission Controls	Electrical Components	Power Assist Accessories	Braking Systems	Hydraulic Accessories	Drive Trains	Transmissions/Transaxles	Suspension Systems	Steering Systems	Metal Repair & Finishing	Trim Replacement	Surface Preparation 2	Refinishing 1	Touch-up & Finishing	Interior Repairs
LEVEL				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
THEMES				A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D
Module Number				2010	2020	2030	2040	2050	2060	2070	2090	2100	2110	2120	2130	2140	2150	2160	2170	2180	2190	2200	2210	2220
Automotive Air Conditioning and Heating					X																			
Text	*p*	*S*	*S*																					
Lab Manual	*p*	*S*	*S*																					
Instructor's Manual	*p*	*T*	*S*																					
Automotive Brake					X							X	X	X										
Classroom Manual	*p*	*T*	*J/S*																					
Shop Manual	*p*	*T*	*J/S*																					
Automotive Electrical & Electronic Systems				X					X		X													
Classroom Manual	*p*	*T*	*J/S*																					
Shop Manual	*p*	*T*	*J/S*																					
Automotive Steering, Suspension & Wheel Alignment												X					X	X						
Classroom Manual	*p*	*T*	*J/S*																					
Shop Manual	*p*	*T*	*J/S*																					

	Format	*Status*	*Junior/Senior High*	Buying & Selling Vehicles	Vehicle Value Appraisal	Engine Diagnosis	Engine Tune-up	Engine Replacement	Engine Reconditioning 1	Engine Reconditioning 2	Alternate Energy Systems	Computer Systems	Safety Systems	Climate Control	Power Assisting	Automatic Transmissions	Drive Train Repair	Wheel Alignment	Body Repair Estimation	Damage Analysis	Damage Repair 1	Damage Repair 2	Refinishing 2	Plastic & Fibreglass	Glass Replacement	Refinishing 3
LEVEL				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES				A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
Module Number				3010	3020	3030	3040	3050	3060	3070	3080	3090	3100	3110	3120	3130	3140	3150	3160	3170	3180	3190	3200	3210	3220	3230
Automotive Air Conditioning and Heating														X												
Text	*p*	*S*	*S*																							
Lab Manual	*p*	*S*	*S*																							
Instructor's Manual	*p*	*T*	*S*																							
Automotive Brake													X													
Classroom Manual	*p*	*T*	*J/S*																							
Shop Manual	*p*	*T*	*J/S*																							
Automotive Electrical & Electronic Systems							X					X	X	X												
Classroom Manual	*p*	*T*	*J/S*																							
Shop Manual	*p*	*T*	*J/S*																							
Automotive Steering, Suspension & Wheel Alignment															X			X								
Classroom Manual	*p*	*T*	*J/S*																							
Shop Manual	*p*	*T*	*J/S*																							

MECHANICS RESOURCES (continued)

THEME CODE:
A. Vehicle Design & Ownership
B. Propulstion Systems
C. Guidance & Control Systems
D. Suspension & Structural Systems

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
J - Junior
S - Senior

Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Modes & Mechanisms	1020 Vehicle Service & Care	1040 Engine Fundamentals	1090 Electrical Fundamentals	1110 Pneumatics & Hydraulics	1130 Mechanical Systems	1150 Ride & Control Systms	1160 Structures & Materials	1170 Metal Forming & Finishing	1190 Surface Preparation 1
LEVEL				1	1	1	1	1	1	1	1	1	1
THEMES				A	A	B	C	C	C	D	D	D	D
Automotive Technology - A Systems Approach					X	X	X	X		X			
Text & Tech Manual	*p*	*S*	*J/S*										
Instructor's Guide	*p*	*T*	*J/S*										
Car Care Book, The					X	X	X	X	X	X			
Text	*p*	*B*	*J/S*										
Instructor's Guide	*p*	*T*	*J/S*										
Complete Automotive Welding Metals and Plastics													
Text	*p*	*S*	*S*										
Student Tech Shop Manual	*p*	*S*	*S*										
Instructor's Guide	*p*	*T*	*S*										
Complete Engine Performance and Diagnostic													
Text	*p*	*S*	*S*										
Student Tech Shop	*p*	*S*	*S*										
Instructor's Guide	*p*	*T*	*S*										

Module Number	*Format*	*Status*	*Junior/Senior High*	2010 Vehicle Detailing	2020 Vehicle Maintenance	2030 Lubrication & Cooling	2040 Fuel & Exhaust Systems	2050 Alternate Fuel Engines	2060 Ignition Systems	2070 Emission Controls	2090 Electrical Components	2100 Power Assist Accessories	2110 Braking Systems	2120 Hydraulic Accessories	2130 Drive Trains	2140 Transmissions/Transaxles	2150 Suspension Systems	2160 Steering Systems	2170 Metal Repair & Finishing	2180 Trim Replacement	2190 Surface Preparation 2	2200 Refinishing 1	2210 Touch-up & Finishing	2220 Interior Repairs
LEVEL				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
THEMES				A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D
Automotive Technology - A Systems Approach					X	X	X	X	X	X	X	X	X	X	X	X	X	X						
Text & Tech Manual	*p*	*S*	*J/S*																					
Instructor's Guide	*p*	*T*	*J/S*																					
Car Care Book, The					X																			
Text	*p*	*B*	*J/S*																					
Instructor's Guide	*p*	*T*	*J/S*																					
Complete Automotive Welding Metals and Plastics																			X					
Text	*p*	*S*	*S*																					
Student Tech Shop Manual	*p*	*S*	*S*																					
Instructor's Guide	*p*	*T*	*S*																					
Complete Engine Performance and Diagnostic						X	X		X	X	X													
Text	*p*	*S*	*S*																					
Student Tech Shop	*p*	*S*	*S*																					
Instructor's Guide	*p*	*T*	*S*																					

Module Number	*Format*	*Status*	*Junior/Senior High*	3010 Buying & Selling Vehicles	3020 Vehicle Value Appraisal	3030 Engine Diagnosis	3040 Engine Tune-up	3050 Engine Replacement	3060 Engine Reconditioning 1	3070 Engine Reconditioning 2	3080 Alternate Energy Systems	3090 Computer Systems	3100 Safety Systems	3110 Climate Control	3120 Power Assisting	3130 Automatic Transmissions	3140 Drive Train Repair	3150 Wheel Alignment	3160 Body Repair Estimation	3170 Damage Analysis	3180 Damage Repair 1	3190 Damage Repair 2	3200 Refinishing 2	3210 Plastic & Fibreglass	3220 Glass Replacement	3230 Refinishing 3
LEVEL				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES				A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
Automotive Technology - A Systems Approach						X	X	X	X	X	X	X	X	X	X	X	X	X								
Text & Tech Manual	*p*	*S*	*J/S*																							
Instructor's Guide	*p*	*T*	*J/S*																							
Car Care Book, The				X	X																					
Text	*p*	*B*	*J/S*																							
Instructor's Guide	*p*	*T*	*J/S*																							
Complete Automotive Welding Metals and Plastics																								X		
Text	*p*	*S*	*S*																							
Student Tech Shop Manual	*p*	*S*	*S*																							
Instructor's Guide	*p*	*T*	*S*																							
Complete Engine Performance and Diagnostic						X	X																			
Text	*p*	*S*	*S*																							
Student Tech Shop	*p*	*S*	*S*																							
Instructor's Guide	*p*	*T*	*S*																							

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MECHANICS RESOURCES (continued)

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Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Modes & Mechanisms	1020 Vehicle Service & Care	1040 Engine Fundamentals	1090 Electrical Fundamentals	1110 Pneumatics & Hydraulics	1130 Mechanical Systems	1150 Ride & Control Systems	1160 Structures & Materials	1170 Metal Forming & Finishing	1190 Surface Preparation 1
LEVEL				1	1	1	1	1	1	1	1	1	1
THEMES				A	A	B	C	C	C	D	D	D	D
Complete Under Car Systems - Steering and Suspension										X			
Text	*p*	*S*	*S*										
Technician Shop Manual	*p*	*S*	*S*										
Instructor's Guide	*p*	*T*	*S*										
Design and Technology	*p*	*T*	*J*	X									
Engineering Technology: Hydraulics and Pneumatics, Part I and Part II (IBM Ver.)	*s*	*S*	*J/S*					X					
Fuel Systems and Emission Controls	*p*	*T*	*S*										
I-Car Unibody Collision Repair											X	X	X
Text	*p*	*S*	*S*										
Instructor's Guide	*p*	*T*	*S*										

Module Number	2010 Vehicle Detailing	2020 Vehicle Maintenance	2030 Lubrication & Cooling	2040 Fuel & Exhaust Systems	2050 Alternate Fuel Engines	2060 Ignition Systems	2070 Emission Controls	2090 Electrical Components	2100 Power Assist Accessories	2110 Braking Systems	2120 Hydraulic Accessories	2130 Drive Trains	2140 Transmissions/Transaxles	2150 Suspension Systems	2160 Steering Systems	2170 Metal Repair & Finishing	2180 Trim Replacement	2190 Surface Preparation 2	2200 Refinishing 1	2210 Touch-up & Finishing	2220 Interior Repairs
LEVEL	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
THEMES	A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D
Complete Under Car Systems - Steering and Suspension									X		X			X	X						
Text																					
Technician Shop Manual																					
Instructor's Guide																					
Design and Technology																					
Engineering Technology: Hydraulics and Pneumatics, Part I and Part II (IBM Ver.)																					
Fuel Systems and Emission Controls				X	X	X	X	X													
I-Car Unibody Collision Repair																X	X				
Text																					
Instructor's Guide																					

Module Number	3010 Buying & Selling Vehicles	3020 Vehicle Value Appraisal	3030 Engine Diagnosis	3040 Engine Tune-up	3050 Engine Replacement	3060 Engine Reconditioning 1	3070 Engine Reconditioning 2	3080 Alternate Energy Systems	3090 Computer Systems	3100 Safety Systems	3110 Climate Control	3120 Power Assisting	3130 Automatic Transmissions	3140 Drive Train Repair	3150 Wheel Alignment	3160 Body Repair Estimation	3170 Damage Analysis	3180 Damage Repair 1	3190 Damage Repair 2	3200 Refinishing 2	3210 Plastic & Fibreglass	3220 Glass Replacement	3230 Refinishing 3
LEVEL	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
Complete Under Car Systems - Steering and Suspension														X	X								
Text																							
Technician Shop Manual																							
Instructor's Guide																							
Design and Technology																							
Engineering Technology: Hydraulics and Pneumatics, Part I and Part II (IBM Ver.)																							
Fuel Systems and Emission Controls			X	X					X														
I-Car Unibody Collision Repair																	X	X	X	X	X	X	
Text																							
Instructor's Guide																							

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MECHANICS RESOURCES (continued)

THEME CODE:
A. Vehicle Design & Ownership
B. Propulsion Systems
C. Guidance & Control Systems
D. Suspension & Structural Systems

FORMAT CODE:
p - Print
v - Video
s - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

JR/SR HIGH CODE:
J - Junior
S - Senior

Module Number	*Format*	*Status*	*Junior/Senior High*	1010 Modes & Mechanisms	1020 Vehicle Service & Care	1040 Engine Fundamentals	1090 Electrical Fundamentals	1110 Pneumatics & Hydraulics	1130 Mechanical Systems	1150 Ride & Control Systems	1160 Structures & Materials	1170 Metal Forming & Finishing	1190 Surface Preparation 1	2010 Vehicle Detailing	2020 Vehicle Maintenance	2030 Lubrication & Cooling	2040 Fuel & Exhaust Systems	2050 Alternate Fuel Engines	2060 Ignition Systems	2070 Emission Controls	2090 Electrical Components	2100 Power Assist Accessories	2110 Braking Systems	2120 Hydraulic Accessories	2130 Drive Trains	2140 Transmissions/Transaxles	2150 Suspension Systems	2160 Steering Systems	2170 Metal Repair & Finishing	2180 Trim Replacement	2190 Surface Preparation 2	2200 Refinishing 1	2210 Touch-up & Finishing	2220 Interior Repairs	3010 Buying & Selling Vehicles	3020 Vehicle Value Appraisal	3030 Engine Diagnosis	3040 Engine Tune-up	3050 Engine Replacement	3060 Engine Reconditioning 1	3070 Engine Reconditioning 2	3080 Alternate Energy Systems	3090 Computer Systems	3100 Safety Systems	3110 Climate Control	3120 Power Assisting	3130 Automatic Transmissions	3140 Drive Train Repair	3150 Wheel Alignment	3160 Body Repair Estimation	3170 Damage Analysis	3180 Damage Repair 1	3190 Damage Repair 2	3200 Refinishing 2	3210 Plastic & Fibreglass	3220 Glass Replacement	3230 Refinishing 3
LEVEL				1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEMES				A	A	B	C	C	C	D	D	D	D	A	A	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
Step-By-Step Guide to Engine Building	*p*	*S*	*S*																																					X	X																
Technology: Today & Tomorrow				X		X																																																			
Text & Workbook	*p*	*S*	*J*																																																						
Teacher's Resource	*p*	*T*	*J*																																																						
Teacher's Annotated	*p*	*T*	*J*																																																						
Making Connections	*p*	*T*	*J*																																																						
Media Correlations	*p*	*T*	*J*																																																						
Today's Electrician: Classroom Manual for Automotive Computer Systems	*p*	*S*	*S*																	X																	X	X					X	X	X												
Shop Manual	*p*	*T*	*S*																																																						
Today's Technician: A Manual Transmissions and Transaxles									X																X	X																						X									
Classroom Manual	*p*	*T*	*S*																																																						
Shop Manual	*p*	*T*	*S*																																																						

OTHER RESOURCES

These titles are provided as a service only to assist local jurisdictions to identify resources that contain potentially useful ideas for teachers. Alberta Education has done a preliminary review of the resources. However, the responsibility to evaluate these resources prior to selection rests with the user, in accordance with any existing local policy.

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
AECD	*Apprenticeship Training: Agriculture Mechanic Program.* Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum Outline. Describes the parameters/course requirements for apprenticeship in the Agriculture Mechanic trade.	1040 to 1150	2030 to 2160	3030 to 3140
AECD	*Apprenticeship Training: Auto Body Technician Program.* Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum Outline. Describes the parameters/course requirements for apprenticeship in the Auto Body Technician trade.	1150 to 1190	2150 to 2220	3150 to 3230
AECD	*Apprenticeship Training: Automotive Service Technician Program.* Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum Outline. Describes the parameters/course requirements for apprenticeship in the Automotive Service Technician trade.	1040 to 1150	2030 to 2160	3030 to 3150
AECD	*Apprenticeship Training: Heavy Duty Technician Program.* Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum Outline. Describes the parameters/course requirements for apprenticeship in the Heavy Duty Technician trade.	1040 to 1150	2030 to 2160	3030 to 3140

Other Resources (continued)

Distributor Code	Other Resources	Levels/Module No.		
		1	2	3
AECD	*Apprenticeship Training: Motorcycle Mechanic Program.* Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum Outline. Describes the parameters/course requirements for apprenticeship in the Motorcycle Mechanic trade.	1040 to 1150	2030 to 2090 2120 to 2150	3030 to 3090 3130 3140
ACC	*Car Owner's Maintenance Guide, A.* Edmonton, AB: ACCESS: The Education Station. Print.	1020	2020	
PAB	*Highway Traffic Act.* Edmonton, AB: Queen's Printer. Includes Inspection of Write-off Vehicles.			3100 3020 3170
ACC	How the Motor Car Works (series). Edmonton, AB: ACCESS: The Education Station. Video. • *The Engine* • *Engine Lubrication* • *The Carburator*	1040	2030 2040	3030 3040
PAB	*Motor Transportation Act.* Edmonton, AB: Queen's Printer. Includes Public Vehicles, general equipment and safety regulations. Commercial Vehicle Maintenance Standards.	all	all	all
PAB	*Occupational Heath and Safety Act.* Edmonton, AB: Queen's Printer. Provides current information on health and safety as it pertains to the workplace.	all	all	all

ADDITIONAL SOURCES

Available to Career and Technology Studies (CTS) teachers, locally and provincially, are many sources of information that can be used to enhance CTS. These sources are available through the community (e.g., libraries, boards, committees, clubs, associations) and through government agencies, resource centres and organizations. Some sources, e.g., government departments, undergo frequent name and/or telephone number changes. Please consult your telephone directory or an appropriate government directory.

The following is a partial list of sources to consider:

TEACHER–LIBRARIANS

Planned and purposeful use of library resources helps students grow in their ability to gather, process and share information. Research activities require access to an adequate quantity and variety of appropriate, up-to-date print and nonprint resources from the school library, other libraries, the community and additional sources. Some techniques to consider are:

- planning together
- establishing specific objectives
- integrating research skills into planning.

Cooperation between the teacher-librarian and the subject area teacher in the development of effectively planned resource-based research activities ensures that students are taught the research skills as well as the subject content. Also see *Focus on Research: A Guide to Developing Student's Research Skills* referenced in the Alberta Education resources section.

ALBERTA EDUCATION SOURCES

Alberta Government telephone numbers can be reached toll free from outside Edmonton by dialing 310–0000.

The following monographs are available for purchase from the Learning Resources Distributing Centre. Refer to the Distributor Directory at the end of this section for address, telephone, fax and Internet address.

Please consult the "Support Documents" section or the "Legal, Service and Information Publications" section in the LRDC *Buyers Guide* for ordering information and costs.

Developmental Framework Documents

- *The Emerging Student: Relationships Among the Cognitive, Social and Physical Domains of Development*, 1991 (Stock No. 161555)

  This document examines the child, or student, as a productive learner, integrating all the domains of development: cognitive, social and physical. It emphasizes the need for providing balanced curriculum and instruction.

- *Students' Interactions Developmental Framework: The Social Sphere*, 1988 (Stock No. 161399)

  This document examines children's perceptual, structural and motor development and how such physical development affects certain learning processes.

- *Students' Physical Growth: Developmental Framework Physical Dimension,* 1988 (Stock No. 161414)

  This document examines children's normal physical growth in three areas: perceptual, structural and motor development. In none of these areas is the child's growth in a single continuous curve throughout the first two decades of life. Physical growth is characterized by periods of rapid growth and periods of slower growth. Consequently, differences and changes in growth patterns may affect the timing of certain learning processes.

Other

- *Focus on Research: A Guide to Developing Students' Research Skills,* 1990 (Stock No. 161802)

  This document outlines a resource-based research model that helps students manage information effectively and efficiently, and gain skills that are transferable to school and work situations. This model provides a developmental approach to teaching students how to do research.

- *Teaching Thinking: Enhancing Learning,* 1990 (Stock No. 161521)

  Principles and guidelines for cultivating thinking, ECS to Grade 12, have been developed in this resource. It offers a definition of thinking, describes nine basic principles on which the suggested practices are based, and discusses possible procedures for implementation in schools and classrooms.

ACCESS: The Education Station

ACCESS: The Education Station offers a variety of resources and services to teachers. For a nominal dubbing and tape fee, teachers may have ACCESS: The Education Station audio and video library tapes copied. ACCESS: The Education Station publishes listings of audio and video cassettes as well as a comprehensive programming schedule. Of particular interest are the CTS videos, which are available with utilization guides. The guides outline key points in each video and suggest questions for discussion, classroom projects and other activities. Video topics are listed in the Support Learning Resources section of this guide. The videos and accompanying support material can be obtained from ACCESS: The Education Station. Refer to the Distributor Directory at the end of this section for address, telephone, fax and Internet address.

GOVERNMENT SOURCES

National Film Board of Canada (NFB)

The NFB has numerous films and videotapes that may be suitable for Career and Technology Studies strands. For a list of NFB films and videotapes indexed by title, subject and director, or for purchase of NFB films and videotapes, call 1–800–267–7710 (toll free) or Internet address: http://www.nfb.ca

ACCESS: The Education Station and some school boards have acquired duplication rights to some NFB videotapes. Please contact ACCESS: The Education Station or consult the relevant catalogues in your school or school district.

The Edmonton Public Library and the Calgary Public Library have a selection of NFB films and videotapes that can be borrowed free of charge with a Public Library borrower's card. For further information, contact:

Edmonton Public Library
Telephone: 403–496–7000

Calgary Public Library
Telephone: 403–260–2650

For further information contact:

Statistics Canada
Regional Office
8th Floor, Park Square
10001 Bellamy Hill
Edmonton, AB T5J 3B6
Telephone: 403–495–3027
Fax: 403–495–5318
Internet address: http://www.statcan.ca

Statistics Canada produces periodicals, reports, and an annual year book.

Resource Centres

Urban Resource Centres

Instructional Services
Elk Island Public Schools
2001 Sherwood Drive
Sherwood Park, AB T8A 3W7
Telephone: 403–464–8235
Fax: 403–464-8033
Internet Address: http://ei.educ.ab.ca

Learning Resources Centre
Red Deer Public School Board
4747 – 53 Street
Red Deer, AB T4N 2E6
Telephone: 403–343–8896
Fax: 403–347–8190

Instructional Materials Centre
Calgary Separate School Board
6220 Lakeview Drive SW
Calgary, AB T3E 5T1
Telephone: 403–298–1679
Fax: 403–249–3054

School, Student, Parent Services Unit
Program and Professional Support Services Sub Unit
Calgary Board of Education
3610 – 9 Street SE
Calgary, AB T2G 3C5
Telephone: 403–294–8542
Fax: 403–287–9739

After July 1, 1997, please contact the School, Student, Parent Services Unit regarding the relocation of the Loan Pool Resource Unit.

Learning Resources
Edmonton Public School Board
Centre for Education
One Kingsway Avenue
Edmonton, AB T5H 4G9
Telephone: 403–429–8387
Fax: 403–429–0625

Instructional Materials Centre
Medicine Hat School District No. 76
601 – 1 Avenue SW
Medicine Hat, AB T1A 4Y7
Telephone: 403–528–6719
Fax: 403–529–5339

Resource Centre
Edmonton Catholic Schools
St. Anthony's Teacher Centre
10425 – 84 Avenue
Edmonton, AB T6E 2H3
Telephone: 403–439–7356
Fax: 403–433–0181

Instructional Media Centre
Northern Lights School Division No. 69
Bonnyville Centralized High School
4908 – 49 Avenue
Bonnyville, AB T9N 2J7
Telephone: 403–826–3366
Fax: 403–826–2959

Regional Resource Centres

Zone 1

Zone One Regional Resource Centre
P.O. Box 6536
10020 – 101 Street
Peace River, AB T8S 1S3
Telephone: 403–624–3187
Fax: 403–624–5941

Zone 2/3

Central Alberta Media Services (CAMS)
182 Sioux Road
Sherwood Park, AB T8A 3X5
Telephone: 403–464–5540
Fax: 403–449–5326

Zone 4

Information and Development Services
Parkland Regional Library
5404 – 56 Avenue
Lacombe, AB T4L 1G1
Telephone: 403–782–3850
Fax: 403–782–4650
Internet Address: http://rtt.ab.ca.rtt/prl/prl.htm

Zone 5

South Central Alberta Resource Centre (SCARC)
Golden Hills Regional Division
435A Hwy 1
Westmount School
Strathmore, AB T0J 3H0
Telephone: 403–934–5028
Fax: 403–934–5125

Zone 6

Southern Alberta Learning Resource Centre (SALRC)
Provincial Government Administration Building
909 Third Avenue North, Room No. 120
Box 845
Lethbridge, AB T1J 3Z8
Telephone: 403–320–7807
Fax: 403–320–7817

OTHER GOVERNMENT SOURCES

Alberta Advanced Education and Career Development
Library
Information and Policy Services
9th Floor Commerce Place
10155 – 102 Street
Edmonton, AB T5J 4L5
Telephone: 403–422–4752
Fax: 403–427–0793

Career Information Catalogue Update, 1994
The Career Planner
Children Challenge Choice
Entrepreneur: A Big Word for Small Business
Rural Women as Business Entrepreneurs
Positive Works
Skills are your Passport.

Videos on career planning and entrepreneurial topics are available through the library of this department. Call 403–422–4752 for more information. The following videos are representative of the library's holdings:

The Entrepreneur
Get a Job
A Head for Business
The Seven Phases of a Job Interview.

Alberta Apprenticeship Program
For more information, contact the Alberta Advanced Education and Career Development office nearest you or call the Alberta Career Information Hotline, 1-800-661-3753 (toll-free), Edmonton 403–422–4266.

Alberta Economic Development and Tourism
Strategic Planning and Research
9th Floor, Sterling Place
9940 – 106 Street
Edmonton, AB T5K 2P6
Telephone: 403–422–9494
Fax: 403–422–5922

Financing a Small Business
Marketing a Small Business
Starting a Small Business.

Alberta Environmental Protection
Education Branch
12th Floor, 9820 – 106 Street
Edmonton, AB T5K 2J6
Telephone: 403–427–6310
Fax: 403–427–2512

Workshops and presentations can be arranged.

Alberta Environmental Protection
Land and Forest Services
9920 – 108 Street
10th Floor, Bramalea Building
Edmonton, AB T5K 2M4
Telephone: 403–427–3551
Fax: 403–427–0292

Alberta Health
Environmental Health Services
Box 1360
14th Floor, 10025 Jasper Avenue
Edmonton, AB T5J 2N3
Telephone: 403–427–2643

Alberta Labour
9940 – 106 Street
Edmonton, AB T5K 2N2
Telephone: 403–427–8848
Fax: 403–427–0999

Offices are also in Calgary, Camrose, Edson, Fort McMurray, Grande Prairie, Lethbridge, Medicine Hat, Red Deer and Vermillion.

Environment Canada
Inquiry Centre
10 Wellington Street, 1st Floor
Hull, Quebec K1A 0H3
Telephone: 819–997–2800
Fax: 613–953–2225

Environmental Council of Alberta
400, 9925 – 109 Street
Edmonton, AB T5K 2J8
Telephone: 403–427–5792
Fax: 403–427–0388

Industry and Science Canada
Consumer Affairs
10225 – 100 Avenue
Edmonton, AB T5J 0A1
Telephone: 403–495–2485
Fax: 403–495–6451

or

Standard Life Tower
400, 639 - 5 Avenue SW
Calgary, AB T2P 0M9
Telephone: 403–292–6183
Fax: 403–292–6175

PROFESSIONAL ASSOCIATIONS

Alberta Teachers' Association
Specialist Council
Barnett House
11010 – 142 Street
Edmonton, AB T5N 2R1
Telephone: 403–447–9400
Fax: 403–455–6481

INDUSTRY ORGANIZATIONS

Alberta Motor Association
10310 – 39A Avenue
Box 8180 St. South
Edmonton, AB T6H 5X9
Telephone: 403–430–5521

Alberta Special Waste Management Corp.
610, 10909 Jasper Avenue
Edmonton, AB T5J 3L9
Telephone: 403–422–5029 or
1–800–272–8873
Fax: 403–428–9627

Motor Dealer Association of Alberta
9249 – 48 Street
Edmonton, AB T6B 2R9
Telephone: 403–468–9552

MOTOR VEHICLE MANUFACTURERS REGIONAL OFFICES

Chrysler Canada Limited
200, 10201 Southport Road SW
Calgary, AB T2W 4X9
Telephone: 403–299–2900
http://www.dodge.com/

Ford Motor Company of Canada Limited
11604 – 181 Street
Edmonton, AB T5S 1M6
Telephone: 403–454–9621
http://www.ford.com/

General Motors of Canada
4220 Blackfoot Trail SE
Calgary, AB T2G 4E9
Telephone: 403–531–5500
http://www.gmc.com/

Honda Canada Inc.
13240 Worster Court
Richmond, BC V6V 2B8
Telephone: 604–278–7121
http://www.honda.com/

Mazda Canada Inc.
400, 2075 Kennedy Road
Scarborough, ON M1T 3V3
Telephone: 1–800–263–4680

Nissan Canada Inc.
Box 2501
New Westminster, BC V3L 5A1
Telephone: 604–526–4581

Toyota Canada Inc.
5330 Skyline Way NE
Calgary, AB T2E 6V1
Telephone: 403–295–1055
http://www.toyota.com/

ENVIRONMENTAL FACILITIES

The following is a partial list of facilities that provide hands-on experience for students in aspects of resource management and environmental education. Contact should be made directly with the facility to obtain details of what is offered to school groups or students.

Energeum
(Energy Resources Conservation Board)
640 – 5 Avenue SW
Calgary, AB T2P 3G4
Telephone: 403–297–4293

Environmental Resource Centre
10511 Saskatchewan Drive
Edmonton, AB T6E 4S1
Telephone: 403–433–4808

OTHER AGENCIES

Canadian Foundation for Economic Education
501, 2 St. Clair Avenue West
Toronto, ON M4V 1L5
Telephone: 416–968–2236
Fax: 416–968–0488

Entrepreneurship: A Primer for Canadians (teacher resource)
Labour Market: Teacher's Resource Package (teacher resource)
Money and Youth
Women in the Work Force.

The Conference Board of Canada
255 Smyth Road
Ottawa, ON K1H 8M7
Telephone: 613–526–3280
Fax: 613–526–4857

Economic Forecast: Provincial Outlook (research reports, personalized information services).

FEESA, An Environmental Education Society

Website: www.telusplanet.net/public/feesa

900, 10150 – 100 Street
Edmonton AB T5J 0P6
Telephone: 403–421–1497
Fax: 403–425–4506
E-mail: feesa@telusplanet.net

FEESA offers education training and resource materials focusing on a variety of environmental and educational needs. Programs are developed in partnership with business, industry, government, environmental and education groups.

Junior Achievement of Northern Alberta
(Alberta north of Lacombe, and NWT)
161, 10700 - 104 Avenue
Edmonton, AB T5J 4S2
Telephone: 403–428–1421
Fax: 403–428–1031

Junior Achievement of Southern Alberta
(Lacombe and South)
739 – 10 Avenue SW
Calgary, AB T2R 0B3
Telephone: 403–263–2545
Fax: 403–261–6988

Materials are available only where Junior Achievement has identified community business consultants and provided inservice.

DISTRIBUTOR DIRECTORY

The entries in the Distributor Directory are arranged alphabetically by code.

CODE	Distributor/Address	Contact Via
ACC	ACCESS: The Education Station 3270 – 76 Avenue Edmonton, AB T6B 2N9	403–440–7777 Fax: 403–440–8899 1-800–352–8293 http://www.ccinet.ab.ca/access
AECD	Alberta Advanced Education and Career Development 10th Floor, Commerce Place 10155 – 102 Street Edmonton, AB T5H 4L5	403–427–8765
LRDC	Learning Resources Distributing Centre 12360 – 142 Street Edmonton, AB T5L 4X9	403–427–5775 Fax: 403–422–9750 http://ednet.edc.gov.ab.ca/lrdc
PAB	Alberta Public Affairs Bureau Queen's Printer Bookstore 11510 Kingsway Avenue Edmonton, AB T5G 2Y1	403–427–4952 Fax: 403–452–0668

MECHANICS

SECTION J: SAMPLE STUDENT LEARNING GUIDES

The following pages provide background information, strategies and a template for developing student learning guides. Also included at the end of this section are several sample student learning guides for Mechanics.

A student learning guide provides information and direction to help students attain the expectations defined in a specified CTS module. It is designed to be used by students under the direction of a teacher.

Many excellent student learning guides (SLGs) are available for use and/or are in the process of being developed. While Alberta Education provides a development template accompanied by some samples, most student learning guide development is being done by individuals and organizations across the province (e.g., school jurisdictions, specialist councils, post-secondary organizations). Refer to the *Career & Technology Studies Manual for Administrators, Counsellors and Teachers* (Appendix 11) for further information regarding student learning guide developers and sources.

Note: A student learning guide is not a self-contained learning package (e.g., Distance Learning Module), such as you might receive from the Alberta Distance Learning Centre (ADLC) or Distance Learning Options South (DLOS).

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  Strategies for Developing Student Learning Guides J.4

SAMPLE STUDENT LEARNING GUIDE TEMPLATE J.5

SAMPLE STUDENT LEARNING GUIDES

  MEC1010 Modes & Mechanisms J.11
  MEC2010 Vehicle Detailing J.17

BACKGROUND INFORMATION

A Student Learning Guide (SLG) is a presentation of information and direction that will help students attain the expectations defined in a specified CTS module. It is designed to be used by students under the direction of a teacher. A SLG is not a self-contained learning package such as you might receive from the Alberta Distance Learning Centre (ADLC) or Distance Learning Options South (DLOS).

Each SLG is based on curriculum and assessment standards as defined for a particular CTS module. Curriculum and assessment standards are defined in this document through:

- module and specific learner expectations (Sections D, E and F)
- assessment criteria and conditions (Sections D, E and F)
- assessment tools (Section G).

The SLG is written with the student in mind and makes sense to the student in the context of his or her CTS program. SLGs are designed to guide students through modules under the direction of the teacher. They can be used to guide:

- an entire class
- a small groups of students
- individual students.

In some instances, the Student Learning Guide may also be used as teacher lesson plans. When using SLGs as teacher lesson plans, it should be noted that they tend to be:

- learner-centred (versus teacher-directed)
- activity-based (versus lecture-based)
- resource-based (versus textbook-based).

Components of a Student Learning Guide

The student learning guide format, as developed by Alberta Education, typically has *seven* components as described below.

1. *Why Take This Module?*

   This section provides a brief rationale for the work the student will do, and also establishes a context for learning (i.e., in relation to the strand, a life pursuit, a specific industry, etc.).

2. *What Do You Need To Know Before You Start?*

   In this section, prerequisite knowledge, skills and attitudes considered necessary for success in the module are identified. Prerequisites may include other modules from within the strand or from related CTS strands, as well as generic knowledge and skills (e.g., safety competencies, the ability to measure/write/draw, prior knowledge of basic information relevant to the area of study).

3. *What Will You Know And Be Able To Do When You Finish?*

   This information must parallel and reflect the curriculum and assessment standards as defined for the module. You may find it desirable to rewrite these standards in less formal language for student use.

4. *When Should Your Work Be Done?*

   This section provides a timeline that will guide the student in planning their work. The timeline will need to reflect your program and be specific to the assignments you give your students. You may wish to include a time management chart, a list of all assignments to be completed, and instructions to the student regarding the use of a daily planner (i.e., agenda book) to organize their work.

5. *How Will Your Mark For This Module Be Determined?*

   This section will interpret the assessment criteria and conditions, assessment standards, assessment tools and suggested emphasis as defined for the module within the context of the projects/tasks completed. Accepted grading practices will then be used to determine a percentage grade for the module—a mark not less than 50% for successful completion. (**Note**: A module is "successfully completed" when the student can demonstrate ALL of the exit-level competencies or MLEs defined for the module.)

6. *Which Resources May You Use?*

   Resources considered appropriate for completing the module and learning activities are identified in this section of the guide. The resources may be available through the Learning Resources Distributing Centre (LRDC) and/or through other agencies. Some SLGs may reference a single resource, while others may reference a range of resources. Resources may include those identified in the Learning Resource Guide (Section I) as well as other sources of information considered appropriate.

7. *Activities/Worksheets*

   This section provides student-centred and activity-based projects and assignments that support the module learner expectations. When appropriately aligned with curriculum and assessment standards, successful completion of the projects and assignments will also indicate successful completion of the module.

Strategies for Developing Student Learning Guides

Prior to commencing the development of a student learning guide, teachers are advised to obtain:

- the relevant Guide to Standards and Implementation
- the student learning guide template.

Information communicated to the student in the SLG must parallel and reflect the curriculum and assessment standards as defined for the module. Therefore, critical elements of the Guide to Standards and Implementation that need to be addressed throughout the SLG include:

- module and specific learner expectations
- assessment criteria and conditions
- assessment standards
- assessment tools.

Additional ideas and activities will need to be incorporated into the student learning guide. These can be obtained by:

- reflecting on projects and assignments you have used in delivering programs in the past
- identifying human and physical resources available within the school and community
- networking and exchanging ideas (including SLGs) with other teachers
- reviewing the range of resources (e.g., print, media, software) identified in the Learning Resource Guide (Section I) for a particular module/strand.

Copyright law must also be adhered to when preparing a SLG. Further information and guidelines regarding copyright law can be obtained by referring to the:

- *Copyright Act*
- *Copyright* and the *Can Copy Agreement*.

A final task in developing a student learning guide involves validating the level of difficulty/challenge/rigour established, and making adjustments as considered appropriate.

A template for developing student learning guides, also available on the Internet, is provided in this section (see "Student Learning Guide Template," pages J.5–10). Several sample student learning guides are also provided in this section (see "Sample Student Learning Guides," starting on page J.11.

CAREER &
TECHNOLOGY
STUDIES

SAMPLE STUDENT LEARNING GUIDE TEMPLATE

WHY TAKE THIS MODULE?

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

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WHEN SHOULD YOUR WORK BE DONE?

12
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HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE

WHICH RESOURCES MAY YOU USE?

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ACTIVITIES/WORKSHEETS

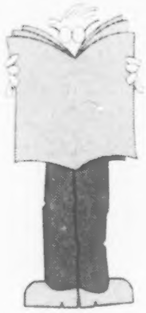
CAREER &
TECHNOLOGY
STUDIES

MECHANICS

SAMPLE STUDENT LEARNING GUIDE

MEC1010 Modes & Mechanisms

WHY TAKE THIS MODULE?



- To learn and apply the design process
- To be creative and build a model of a transport vehicle
- To apply marketing and advertising skills during your sales campaign
- To learn about aerodynamics in all types of vehicles
- To test and evaluate your vehicle
- To use and compile a portfolio.

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

There are no prerequisites identified for this module.

However, an understanding of the design process will be an asset. An ability to follow safe lab procedures and safety regulations and to work cooperatively with others will ensure success.

MEC1010 Modes & Mechanisms

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

Upon completion of this module, you will be able to:

- demonstrate safe use of tools, and follow established lab procedures
- list and describe operating systems and structures common to all modes of transportation
- research, design, build and test a concept vehicle
- demonstrate basic competencies.

WHEN SHOULD YOUR WORK BE DONE?

Your teacher will give you a timeline for completing tasks and assignments within this module.

You may also wish to use a time-management planning chart to preplan the work that needs to be done in this module. Plan how you will use your class time as well as extra time needed to complete the assignments in this module.

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MEC1010 Modes & Mechanisms

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	EMPHASIS
You must first demonstrate **all** of the competencies required for this module. When you have done this, your mark for the module will be determined as follows:	
• Research of a particular vehicle	10%
• Sketches and working drawing	20%
• Advertising campaign posters	10%
• Vehicle construction and performance	40%
• Safe use of tools and machines	10%
• Evaluation (self & teacher)	10%

WHICH RESOURCES MAY YOU USE?

- Technology Learning Wheel (1) Aerodynamics (2) Solar (3) Wind (4) Aerospace (5) Mag. Lev.
- Hacker, *Living with Technology*
- Browning, *Design and Technology*
- Gradwell, *Technology Shaping Our World*
- Science Directions 7 (Unit 3) 8 (Unit 2) & 9 (Unit 4)

ACTIVITIES/WORKSHEETS

STATEMENT OF A PROBLEM: Following the Design/Problem-Solving Process you will design and construct a model of a transportation vehicle using a simple power source, common materials and tools.

You will show marketing skills by designing a poster that promotes your vehicle.

RESEARCH: Using your science textbooks and the references provided, complete the following in your portfolio:

1. Describe the forces that are to be overcome when a vehicle moves:
   - on land
   - in water
   - in air
   - in space.

2. Determine what techniques can be used to:
   - start and stop a vehicle
   - speed up and slow down a vehicle
   - control the direction of a vehicle
   - give a vehicle stability.

3. Demonstrate and/or describe how energy can be used to produce motion in a:
   - spring
   - elastic
   - CO_2 capsule
   - electromagnetic device.

ALTERNATIVE SOLUTIONS: Brainstorm and sketch three thumbnail drawings of your transportation vehicle and place into your portfolio.
Note: Remember your vehicle could be a land, air or water vehicle.

FINAL SOLUTION: Use drawing instruments to produce an orthographic drawing that shows the top and side of your concept vehicle. Place this drawing in your portfolio.

CONSTRUCTION: Choose the appropriate materials to construct a prototype by considering their:
- workability
- strength
- weight
- cost.

Safely construct the vehicle according to the specifications and working drawings.
Apply a finish to the vehicle to:
- enhance its appearance
- increase its performance
- increase its longevity.

MEC1010 Modes & Mechanisms

EVALUATION: Test the vehicle individually or in competition with others in relation to:
- its speed in metres per second
(Speed = $\frac{\text{Distance}}{\text{Time}}$)
- load in grams.

PRESENTATION: During construction there may be some down time owing to the absence of machinery. You may design your advertising and marketing poster, which will be used for the final presentation of your transportation vehicle. The poster will be designed by you but it must include the following information:

1. The name of your vehicle
2. A colour drawing of the vehicle
3. Promotional information and any relevant data.

BE CREATIVE

CAREER &
TECHNOLOGY
STUDIES

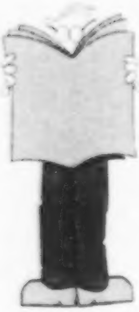
MECHANICS

SAMPLE STUDENT LEARNING GUIDE

MEC2010 Vehicle Detailing

MEC2010 Vehicle Detailing

WHY TAKE THIS MODULE?



- Today's modern vehicles reflect the many different attitudes and values of their owners. Through colour and graphic enhancement owners are able to express their personal satisfaction and pride in their vehicle. In this module, you will experience and become knowledgeable in the methods used to enhance exterior surfaces and engine compartments.

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

There are no prerequisites identified for this module.

However, to work successfully in this module you should be able to:

- use basic hand tools and power drills in a safe manner
- follow instructions as given by product manufactures
- work patiently and use time effectively.

MEC2010 Vehicle Detailing

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

Upon completion of this module you will be able to:

- state personal and environmental hazards associated with the use of cleaning and waxing agents
- identify and describe materials available to enhance the appearance of a vehicle
- demonstrate correct cleaning and treatment of engine parts and exterior finishes, including paint, glass, vinyl and rubber surfaces
- install a trim or accessory part according to standard practice
- demonstrate basic competencies.

WHEN SHOULD YOUR WORK BE DONE?

Your teacher will give you a timeline for completing tasks and assignments within this module.

You may also wish to use a time-management planning chart to preplan the work that needs to be done in this module. Plan how you will use your class time as well as extra time needed to complete the assignments in this module.

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MEC2010 Vehicle Detailing

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	EMPHASIS
You must first demonstrate **all** of the competencies required for this module. When you have done this, your mark for the module will be determined as follows:	
• Safe use of materials and tools	10%
• Identification of products best suited for the work to be done	10%
• Knowledge of trim options and methods of application and fastening	10%
• Project completion: exterior clean and wax, trim repair, installation, engine beautification.	70%

WHICH RESOURCES MAY YOU USE?

- Basic set of hand tools, hand drill and bits and specialty trim removal tools as required
- Trim products: pin striping, decals, molding, spray paint and any student-purchased accessory to be installed
- Assortment of degreasers, cleaners, waxes and related application products and tools
- Engine spray paint and miscellaneous hardware (as required).

MEC2010 Vehicle Detailing

ACTIVITIES/WORKSHEETS

Activity 1

Challenge: Identify painted and trim surface flaws and follow methods described by product manufacturer to correct and enhance the appearance using degreasers, waxes and possibly trim paint.

Limitations: Vehicles must be in reasonably good shape, where products used will be effective in meeting the expectations.

Expectations:

- A complete vehicle cleaning, using suitable products and procedures. This is to be followed by minor surface flaw corrections, e.g., light sanding or touch-up with spot paint.
- Wax and polish surfaces using methods described by product manufacturers. Include chrome, rubber, vinyl and other trim.
- Glass cleaning using appropriate product.

Resources: Catalogues from local auto supply stores, e.g., Canadian Tire, UAP
Service/product manual from Meguiars product line.

Activity 2

Challenge: Remove and/or replace trim parts using appropriate tools and methods. This may include installation of a new trim part and an examination of three or four methods of fastening trim (e.g., clips, two-way tape, blind nuts, etc.).

Limitations: Vehicle type or budget in the case of new trim parts.

Expectations:

- Use appropriate tools to remove window and side trim as applicable and replace.
- Install an accessory trim part such as side molding, mud flaps, running boards or other as desired.
- Apply pin striping and/or decaling to enhance the appearance of the vehicle. Repeat.

Resources:

- Auto supply dealers and supply catalogs
- *Autobody Repair and Refinishing*, Hogg (1988): Fasteners
- Product installation manuals when available.

MEC2010 Vehicle Detailing

Activity 3

Challenge: To clean and paint, for visual enhancement, the engine compartment of a vehicle.

Limitations: Vehicle should be in need of work where the end product is indeed enhancing and visually rewarding.

Expectations:

- Safely use degreaser and cleaners to clean the engine compartment, avoiding damage to electrical and other related systems.
- Follow safety instructions provided in repainting of the engine and adjacent surfaces to produce a like-new appearance, and generally clean up the area by grouping or realigning wires and hoses.
- Service the hinges, latch and hood anti-vibration bumpers.
- Optional: Install owner-purchased accessories used for visual enhancement, e.g., chrome or wire/hose coverings.
- Service battery terminals and battery.

Resources:

- Auto service manual, engine cleaning
- Peterson publication(s) Engine Beautification

Other Suggested Activities

1. Visit two local auto accessory stores to examine the cost of parts desired and their availability.
2. Visit a local auto dismantler to examine variations in trim, design and fastening. Also examine the value in used parts that are available. Remove and purchase desired trim or parts required for a repair.
3. Career exploration: Visit a professional trim application service centre or arrange for a professional trim applicator to visit the class.

K. ACKNOWLEDGEMENTS

The Mechanics strand was developed through the cooperative effort of people from schools, post-secondary institutions, professional associations, business, industry, labour, and departments and agencies of the Government of Alberta. Alberta Education would like to extend sincere appreciation to the following individuals and groups.

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